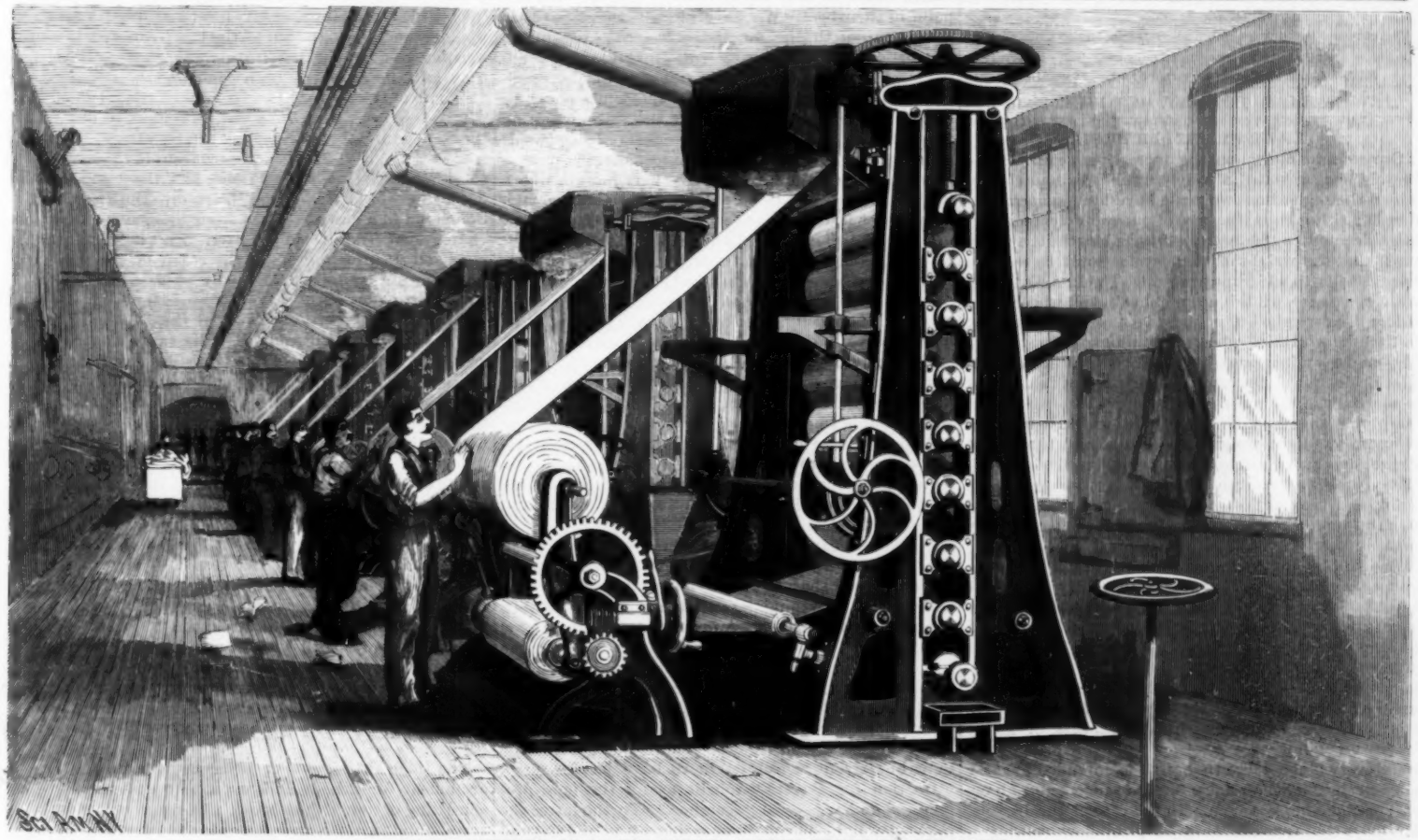
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.] [Copyright, 1898, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS CHEMISTRY, AND MANUFACTURES.

Vol. LXXIX.—No. 16. ESTABLISHED 1845. NEW YORK, OCTOBER 15, 1898. $3.00 A YEAR. WEEKLY.



SUPER-CALENDER ROLLS FOR GIVING A HIGH FINISH TO THE PAPER.

THE MANUFACTURE OF PAPER—FOURDRINIER PAPER MACHINES.—[See page 249.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... $3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885) ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, OCTOBER 15, 1898.

LIGHT-WEIGHT BICYCLES.

Our recent editorial on the increasing weight of the bicycle has provoked a widely extended discussion in which the suggestions we made have been generally indorsed; although in the case of one or two contemporaries devoted to the interests of the bicycle, the statement that the weight of the bicycle should be reduced has called forth a vigorous protest. The L. A. W. Bulletin, for instance, while it admits that in 1895 wheels were ridden that weighed 20 pounds, is quite satisfied that in 1898 the weight of wheels should have risen to 28 or 20 pounds—an increase of fifty per cent in three years. The Bulletin is of the opinion that this added weight is necessary, if the public is to be provided with a thoroughly reliable mount. "Nevertheless," says our contemporary, "light weight is desirable, and the lowest weight at which a machine can be produced which will embody all the essential features is what the public want, and they will demand it and get it, as soon as some one points out how the reductions can be correctly made."

The problem of the proper weights of the bicycle is, or rather should be, dependent primarily upon the weight of the rider. If an engineer is called in by a county board to design a bridge, his first inquiry will be as to the loads the bridge must carry. The amount of metal he will put into it will be absolutely determined by the maximum loads that are liable to come upon it. If the structure is intended to carry droves of cattle, marching regiments of soldiers, or heavy traction engines, the steelwork of the bridge will weigh very much more than if it is intended to carry nothing heavier than a few foot passengers and an occasional one-horse wagon. In the case of the bicycle, however, this very elementary and obvious consideration is entirely ignored, and the same weight of wheel is provided for the 100 as for the 225-pound rider. Judged from the standpoint of scientific design, this is doing things in a very rough-and-ready, rule-of-thumb way. The light rider is taxed for the sake of the heavyweight; and it is a proposition which needs no demonstration, that if a 100 pound man is riding a wheel which will carry a 250 pound man with a proper margin of safety, he is penalized to the extent of from five to eight pounds of unnecessary weight, which he must drag over hill and dale with not the least resulting benefit to himself.

The weight of the wheel is determined, primarily, by the weight of the heaviest riders. There is not a first-class maker in the country who would hesitate to supply a 200 to 225-pound rider with a standard wheel taken from stock, for he knows that the wheel has been built to carry that load. Having built their machines to withstand the "maximum load," the makers feel perfectly secure as regards the riders of moderate weight.

In the first place, then, there should be at least two weights of machine, to secure the best results, and provide a rider with a wheel that contained no unnecessary material. If the public demanded that wheels be built to match the weight of the rider, they would be accommodated. It is more convenient and profitable to the manufacturer to turn out only one grade; but the demand for classification of wheels according to weight of rider—at least to the extent of providing two grades—would be so reasonable that it would meet with a ready response.

With wheels built according to weight, the problem of reducing weight would be greatly simplified. The manufacturer would be no longer handicapped by a "live load" of say 225 pounds, except in the case of the heavyweight wheels, the demand for which would probably not exceed twenty per cent of all the wheels sold. "Shock," to which is due most of the failures in forks and frames, results from suddenly arrested momentum, and momentum is the product of mass or weight by velocity. If the weight is reduced by from forty to fifty per cent, so is the shock to which the wheel is exposed in striking large rocks on the road, passing over badly laid crossings, or in collisions. A reduction of forty to fifty per cent in the stresses to which a machine is subjected allows a proportionate reduction in the weight and strength of that machine, whether it be a locomotive or a bicycle. Just how much reduction can be made in the case of the bicycle, in which the destructive forces at work are chiefly dynamic, could only be proved by experiment; but that it would be considerable is proved by the fact that in 1895 twenty-pound wheels, which had been put together with the conscientious care that marked the construction of the lighter and more costly wheels of that date, did carry heavy riders through a season of hard usage.

We have been asked to state in detail just where the reduction in weight could be made; we reply that the total reduction in pounds can only be gained by taking off ounces or fractions of ounces at every possible point in the wheel. We have already suggested that by increasing the height of the frame to reasonable proportions and introducing a diagonal strut, all bending strains in the plane of the frame would be eliminated, and the reinforcements of the joints could be considerably lightened without in the least impairing its strength. By returning to sprockets of reasonable diameter and cutting out of the sprockets all unnecessary metal, many ounces of weight may be saved, both in the sprockets and in the reduced length of the chain. The lighter pedal pressures, due to the use of moderate gears, would allow some slight reduction in the weight of pedals and cranks—not a great reduction, perhaps, in itself, but something that would go to make up the five or six pounds that could be taken off the present wheel. By abolishing the divided crank axle, with its heavy sleeve, and returning to crank hangers of moderate dimensions, more weight could be saved. There is a certain combined 32-tooth sprocket, cranks and axle in considerable demand just now which must weigh double what the same parts did in the machine of 1895. We have lately seen barrel hubs that were cast in the same generous mould—massive chunks of metal which, in comparison with the small and thoroughly efficient hubs of the earlier wheels, are hideous and clumsy to the last degree.

The largest saving of weight, of course, is possible in the tires. Here we tread on debatable ground, for we are well aware that there are thousands of riders who believe that anything less than a 1⅝-inch tire is a "snare and a delusion." A few years ago, it is true, the 1¼ and 1⅜-inch tires were unable to stand the test of road work; but so rapid has been the improvement in the art, that there are certain makes of light, small-diameter tires that will hold up a rider indefinitely upon the average roads which a tourist encounters.

In conclusion, we draw attention to the fact that the light but strong wheel ought to have just as much attraction for the staid tourist as for the most pronounced and wild-eyed "scorcher." To the latter the reduced weight means that, riding up to and beyond the limit of his strength, he is able to get more speed out of his wheel for the same power. To the tourist the reduced weight means that he can maintain his old gait with considerably less expenditure of power. That this gain in efficiency is desirable, no wheelman can deny, and it is equally true that the manufacturers will provide it just as soon as the riding public makes the demand.

OUR LATEST BATTLESHIP.

With the successful launching on October 4 of the "Illinois," the total number of first class battleships afloat in our navy was raised to eight. The others are the "Iowa," "Oregon," "Indiana," and "Massachusetts," which are in active service, and the "Kearsarge," "Kentucky," and "Alabama," which are nearing completion, the two former at the yards of the Newport News Shipbuilding Company, where also the launch of the "Illinois" took place, and the last named at the Cramp's shipyard, Philadelphia. The "Illinois" is one of three vessels whose construction was authorized by Congress in 1896. The other two are the "Alabama" and the "Wisconsin," the latter of which will be launched within a few weeks by her builders, the Union Iron Works, of San Francisco.

In estimating the power and all-round efficiency of the new battleship, we cannot do better than compare her with another ship of the same class with which the public has become thoroughly familiar—the "Oregon." Measured on the basis of the displacement, the "Illinois" is about 1,237 tons larger, the normal displacement of the "Oregon" being 10,288 tons, and that of the "Illinois" 11,525 tons. A comparison by displacement of two ships built at an interval of six years (the "Oregon" was authorized in 1890 and the "Illinois" in 1896) does not, however, give an adequate idea of the superiority of the later over the earlier vessel, as the improvements in the methods and materials of warship construction in the interim render the later ship, weight for weight, a greatly superior fighting machine.

In a general way it may be said that mere increase in size means increase of efficiency, for the larger ship will be more stable as a gun platform, will be less affected by a head sea, and in case of an artillery duel to the death will possess a larger reserve of buoyancy, that is to say, it would take a larger number of shot holes to sink her.

Judged as a seagoing vessel, the most marked advantage of the "Illinois" over the older ship is in her increased freeboard. The main deck in the "Oregon" is about 12 feet above the waterline, but the "Illinois" is provided with a spar deck which extends above the main deck for over two-thirds of the ship's length. This raises the freeboard to 20 feet forward and amidships and 13¼ feet aft, an increase which would enable her to steam full speed and with fairly dry decks into a sea which would roll green water over the bows and forward turrets of the "Oregon." The advantage of freeboard was noticed during the Santiago blockade, when the "Oregon," or one of her type, was steaming to Guantanamo in company with the "Texas" (a high freeboard ship) against a nasty head sea. The "Texas" was dry and buoyant, while the low freeboard vessel was plunging heavily. A further advantage resulting from lofty decks is the high command of the guns. The bore of the forward 13-inch guns of the "Illinois" will be 26½ feet above the water, as against 18 feet for the "Oregon." The other guns will be carried at the following heights: The 6-inch guns from 15 to 22¼ feet, the 6-pounders from 30 to 40 feet, and the 1-pounders in the tops will be from 60 to 80 feet above the waterline. Command in a gun at sea has been likened in its advantages to "reach" in a boxer. Not only are the guns and their mounts out of the reach of the waves, but their projectiles are less likely to be deflected by striking the tops of the waves.

The protective arrangements of the "Illinois" are greatly superior. Not only does she carry armor of a greater resisting quality, but it is better disposed. The side armor of the "Oregon" only extends in the wake of the engines, boilers, and magazines, that of the "Illinois" is carried right up to the bow. The bow of the "Oregon" might be broken in by rapid-fire shells, letting water into the forward compartments and throwing the ship out of trim. This could scarcely happen to the "Illinois," whose bow at the waterline will be protected with 4 inches of Harveyized steel—sufficient to burst the shells of medium caliber on the outside of the vessel. The protective deck, moreover, will be heavier, being 2¾ inches on the flat and 3 to 4 inches on the slopes, as against a uniform thickness of 2¾ inches in the "Oregon." The heavy armor of the sides, turrets, and barbettes will be of about the same thickness as that of the "Oregon;" but as it will embody the improvements in the art of armor manufacture which have taken place in the past six years, its resisting qualities will be considerably greater.

The same degree of improvement is noticed in the armament, for although the main battery is the same, consisting of four 13-inch guns, the improvements in turrets and turret gear, in mounts and breech mechanism, are such as to greatly increase the efficiency of these weapons in the "Illinois." When we come to the secondary or intermediate armament, we are on debated ground. In the "Oregon" this consists of eight 8-inch and four 6-inch slow-fire weapons, while in the "Illinois" it is represented by fourteen 6-inch rapid-fire guns. The twelve guns of the "Oregon" are capable of about nine shots per minute, under favorable circumstances, whereas, under similar conditions, the fourteen guns of the "Illinois" could deliver between eighty and ninety shots in the same time. The destructive and crippling effect of an 8-inch shell would be enormously greater than that of a 6-inch shell, but the chances of making a hit would be 9 to 1 in favor of the rapid-fire weapons. The results at Santiago show that rapidity of fire is of prime importance, and seem to confirm the wisdom of our naval authorities in replacing the 8-inch slow-fire by the 6-inch rapid-fire guns.

But what a pity that we do not possess an 8-inch rapid-fire gun in our navy.

The 6-inch battery is disposed on two decks and is protected by a complete wall of armor 5½ and 6 inches in thickness; moreover, the effect of a bursting shell is localized by walls of 1½-inch steel which extend out from the sides of the ship between each pair of guns. Other improvements will be found in the method of supplying ammunition to the guns and in the mounting and general handiness of the guns themselves.

Taken altogether, the "Illinois" is a great advance upon the earlier ships, the only point in which the "Oregon" approaches her being that of speed. The "Oregon," on her trial trip, made 16·8 knots; the contract speed of the "Illinois" is 16 knots. As there is no speed premium attached to the later vessel, it is not probable that it will exceed, even if it equals, that of the Pacific coast vessel.

IMPORTING SONG BIRDS FOR OUR WOODS.

Humiliating as it is, the fact must be recognized that our native song birds have been so flagrantly destroyed that many varieties have become rare visitors in our woods and parks, and a few are even threatened with total extinction. The attempts to protect the birds adequately have only succeeded partly in stemming the crusade of destruction, and in no instance have these protective measures resulted in any material increase in the number of songsters. It is believed by experts that the work of killing off the birds has gone

so far that it is quite essential that their numbers should be multiplied by some artificial means. The ordinary processes of nature are too slow, considering the great mortality that must, of necessity, obtain among birds beset by so many enemies as our native songsters are from the moment of their birth until they reach maturity.

There has, consequently, been started a movement among the bird societies of the country which promises to make a complete change in the character of our woods, fields, and parks in a comparatively short time. There has always been a large importing trade in birds in New York, and thousands of Europe's best singers have been brought to this country annually; but these canaries, bullfinches, nightingales, and linnets have all been reared for cage life. They have found their way into innumerable pleasant homes, where their singing is understood and appreciated. New York's bird importing trade has amounted to many thousands of dollars annually, and, with the steady decrease in the numbers of our native songsters, it has expanded and broadened. To-day there are some half dozen large importing houses which make a specialty of handling the song birds of Europe, while retail traders are scattered all over the country.

But now the bird importers have a new demand for their stock. From all parts of the country bird societies and private individuals are purchasing the European song birds for the purpose of restocking the woods, fields, and parks of the country with little warblers. It has been found easier to import certain foreign song birds here than to attempt to increase the numbers of native singers by artificial means. In Europe the song birds are raised on a large scale for commercial purposes, and they can be purchased in quantities cheaper than our own native birds.

Some ten years ago the question was seriously discussed, "Can the European song birds be successfully introduced and reared in this country?" The only answer to this was a practical experiment. A number of nightingales and English skylarks were imported and turned loose in Connecticut and Massachusetts. Great expectations were entertained, but the experiment was doomed to failure. The birds were seen a number of times after they were given their liberty. Then they disappeared entirely. Another lot was imported and turned loose in the northern part of New York city, but, like the first importation, the birds soon died. This was so discouraging that for a time the matter rested. It was supposed that our climate was not suited to the health of these little foreign singers.

But it was hinted by some bird fanciers that the English nightingale was about the hardest of the European songsters to acclimate, and that there were many good song birds in the Harz Mountains which might find this country a congenial home. Following this, a bird society in far-off Oregon decided to make an experiment. Mr. Frank Dekum, a public spirited resident of Portland, was president of the society, and Mr. C. F. Pfluger secretary, and together they raised enough subscriptions to purchase a large consignment of European birds. The Web Foot State has some of the finest game birds in the world, but its woods have always been barren of song birds, and it was considered quite an achievement to stock the fields and parks with song birds from Europe that the Eastern bird societies had failed to introduce.

The first consignment was a large and representative one. There were three hundred pairs of song thrushes, skylarks, goldfinches, siskins, woodlarks, black thrushes, chaffinches, crossbills, black starlings, green finches, bullfinches, robin redbreasts, linnets, singing quails, goldanners, forest finches, and both the plain and blackheaded nightingales. This large company of singers left Europe in perfect condition, but they had a rough ocean voyage, and a number of them died before they reached New York, and many others were sick and worn out. They reached their destination twenty-two days after starting from Germany. They were turned loose in the fields, woods, and parks near Portland. Beforehand, however, they were placed on exhibition in cages, and thousands of people went to visit them. Some of them, after they had rested a day or two, began to pipe and warble, and by the time they were given their liberty they were in a very tuneful condition.

Without waiting to see if this first consignment proved a failure or success, the same enterprising society had a second lot imported in the autumn of 1892. As it was considered dangerous to turn them loose just before a hard winter, this consignment of birds was wintered in a large aviary erected for them by the president of the society. The following spring they were given their liberty in the city park and the adjoining woods and grounds. The birds, upon being released, hopped about among the trees, singing and twittering joyfully. Then many of them gradually disappeared in the woods, while the finches and linnets took up their abode in the park.

The results of these two experiments were watched anxiously by bird-lovers all over the United States. If they should prove adaptable to their new home, it would be the beginning of a great movement for importing European songsters. The following summer, the birds were not only found in the woods and fields, but many of them were building nests, and before another winter came around they had more than doubled their numbers. Since then they have increased rapidly, with but few exceptions. The woods are full of singing skylarks, woodlarks, linnets, and finches. The nightingales, however, did not do well, pretty conclusively proving that the Eastern bird societies happened to select the most difficult singer to acclimate. At first the range of the imported singers was limited to the woods within a few miles around Portland, but now they have extended to neighboring counties, and the skylarks in particular are found in plentiful numbers all over the State. These birds rear from two to four broods every season, and flocks of hundreds of them can be seen any day in the fields of the Web Foot State.

Next to the skylarks, the song thrushes and woodlarks multiplied the quickest, and then followed the starlings and the goldfinches and chaffinches. The most remarkable thing about these little strangers was their migration. When the cold winters swooped down upon the State, the birds took their departure to warmer climes. In October many of them were found in California, journeying southward in flocks. Later they appeared in Southern California; then some of them were reported in Mexico, and a few of them went as far south as Central America. But as soon as spring returned they retraced their steps, and never stopped on their way to breed until they reached Oregon and Northern California. Here they built their nests near the place where they had first been given their freedom, and every summer since they have returned to their first home as regularly as our native migrants. Some of them were hardy enough to withstand the rigors of our climate, and they wintered in the dense forests of the Cascade and Coast mountain ranges.

These birds are not so high priced as the cage birds which are trained to sing certain tunes and to live comfortably in confinement. They are wild and semi-wild singers, trapped in the woods for this purpose, and shipped to this country immediately. They would not live long in confinement, nor would the cage birds live long in the woods. By ordering them in numbers, the singers can be obtained as low as $1 a pair for skylarks and woodlarks, while nightingales cost from $5 to $10 per pair. The chaffinches and goldfinches are 50 cents to $1 apiece and the bullfinches a little more.

G. E. W.

THE UNIFORM OF THE SAILOR.

In the issue of the SCIENTIFIC AMERICAN for last week the reader will find an article on the "Uniform of the Soldier" which deals with the origin of the army uniform. We will now take up briefly the consideration of the navy uniform, and for our facts we are indebted to an interesting article in The New York Sun.

In the days of the Continental Army navy blue, red, and buff prevailed, but in the navy to-day the only colors to be seen are blue, white, silver, and gold. For many years the American naval officers had their uniforms lined with either red or white, but this was abandoned before the war of 1812. The records of the Navy Department show that the first American naval uniform was authorized by the Massachusetts Council in 1776, the resolution being adopted that the uniform of the officers be green and white, and that the colors be a white flag with a green pine tree and an inscription "An Appeal to Heaven." On the 5th of September, 1776, the Marine Committee met at Philadelphia and issued an official regulation. The captain's uniform should be blue cloth with red lapels, slashed cuffs, standup collar, yellow buttons, blue breeches, and red waistcoat. A midshipman had a blue lapeled coat, cuffs faced with red, and with red at the button and buttonholes. In full dress gold lace was introduced and red was eliminated. The coats were of dark blue, with white linings and white cuffs.

In the spring of the next year there was a further change, which is noted in some manuscript papers of Paul Jones, preserved in the Library of Congress, blue coats with white linings and white cuffs, narrow white lapels, red down the whole length of the waist, and, instead of the red waistcoat and breeches, white ones were prescribed. The regulations said that gold epaulets were to be worn on the right shoulder, the figure of a rattlesnake being embroidered on the straps of the epaulets, with the motto, "Don't Tread on Me." The yellow flat buttons on the waistcoat also had the impression of the rattlesnake and the motto, "Don't Tread on Me." Various portraits of Paul Jones, Capt. Nicholas Biddle, Commodore Edward Preble, Commodore Alexander Murray, and Commodore John Barry are instructive links in the history of the evolution of the uniform, and show that the commanding officers introduced certain changes. Beginning with the order in 1830 of John Branch, Secretary of the Navy, the uniform was materially changed and further changes were introduced perhaps a dozen times before the present styles were adopted. Secretary Branch made the full dress coat of dark blue cloth lined with white. It was double breasted, with long lapels and cut with a swell; nine buttons on each lapel, which was to be buttoned back, and an equal number of buttonholes worked in twist as long in width as the lapels would allow. It had a standing collar lined with white and embroidered with gold. Two gold epaulets, faced with white, and white breeches with small naval buttons and gilt knee buttons, white silk stockings and shoes with gilt buckles completed the costume. Under these regulations epaulets were only to be used with cocked hats or caps. Lieutenants wore only one epaulet. Until the year 1839, the marines wore green coats with white or buff facings, but in that year it was changed to blue with red facings. The color has not since been altered and the members of the marine corps still wear coats of blue with red linings. The uniform of the sailors has changed as frequently as that of the officers. Up to 1835 they wore red waistcoats when in their mustering suit, but between that time and 1839 they wore blue cloth jackets and trousers and white shirts, with large blue nankeen collars and fronts trimmed with rows of white tape.

The introduction of new grades into all branches of the navy, in 1866, necessitated a reorganization of the navy uniform, which was done by Secretary Welles. At the present time the special full dress coats of all commissioned officers, except chaplains, is of dark navy blue cloth, double breasted, lined with white silk serge, the waist of the coat to descend to the top of the hip, the skirts to begin about one-quarter of the way from the front edge and descend four-fifths of the distance from the hip bone to the knee. Two buttons are on the waist behind and one near the bottom of each fold. Two rows of large naval buttons are on the breast, nine in each row, the rows being from four to five inches apart, from eye to eye at the top, and two and one-half inches at the bottom. The collar has one strap of heavy gold wire or thread lace around the top and down the front, the width varying according to rank. The frock coat is lined with black silk serge, and has shoulder attachments for epaulets.

The service coat is made to descend to the inseam of the trousers and is single breasted. The collar edges of the coat, side seams, and edges of the hip slits are trimmed with lusterless black mohair braid, one and one-quarter of an inch wide. On each side of the collar is embroidered in high relief, one inch in width, the corps badge and grade devices. The trousers are of dark navy blue cloth and have a strip of gold lace down their outer seams. Instead of the red or white waistcoat of former years, the one now worn is a dark navy blue. Gold lace ornaments are worn on the sleeves to designate the rank of the officers. They vary in width according to rank. The staff officers, except chaplains, wear the lace of their rank, but, in addition, have bands of colored cloth around the sleeve, medical officers using dark maroon velvet; pay officers, white cloth; engineer officers, red cloth; naval constructors, dark violet cloth; professors of mathematics, olive green cloth; civil engineers, light blue velvet.

On epaulets, rear admirals have two stars, with a silver foul anchor in the center; commodores have one star, with a silver foul anchor at each end; captains have a silver spread eagle in the center, with a silver foul anchor at each end; and commanders have a silver oak leaf at each end, with a silver foul anchor in the center. A gold oak leaf is used in a similar way by lieutenant-commanders, and lieutenants substitute two silver bars at each end for the leaves, while ensigns have to be content with a single foul anchor.

All commissioned officers, except chaplains, are also provided with a rigid cocked hat, made of silk beaver. The rank is distinguished by various decorations and trimmings. Of course, these hats are only used for state occasions, and the ordinary navy cap is used on shipboard.

SPANISH WOODEN BULLETS.

It is well known that Spanish soldiers in Cuba were poor marksmen, but great surprise has been expressed at the remarkable lack of execution which characterized their fire at Guantanamo and Santiago, and an officer of the United States gunboat "Montgomery" has been able to throw some light on the matter. He visited the "Maria Teresa" after the destruction of Cervera's fleet in search of souvenirs. He found a large number of Mauser cartridges in groups of five ready to go into the magazines of the guns, and, if the entire Spanish army and navy were equipped with that kind of ammunition, both Cervera and Toral were amply justified in surrendering when they did. The cartridges consisted of a metal shell loaded with hair and a sprinkling of powder. The bullet was of neither brass nor lead, but of wood. Some army contractor had imposed on the ordnance bureau of the Spanish navy, but to what extent the wooden Mauser bullets were used will probably never be known.

PENSIONS IN NEW ZEALAND.—In New Zealand a law allows a yearly pension of almost $200 to every needy and respectable person who has passed the age of 65 years and has lived for 20 years in the colony.

A CYCLONE IN NEW YORK STATE.

A cyclone is a horror which we are apt to consider indigenous to the West, as far as this country is concerned. Fortunately, in the East we rarely suffer from such terrible manifestations of the power of wind, but on September 26 a funnel-shaped cloud appeared out of Lake Ontario a little before 4 P. M., and, gathering force as it came from the lake, swept over the Niagara peninsula from northwest to southeast. Running parallel to the Welland Canal, it cut a swath 300 feet wide from lake to lake, and did an incredible amount of damage, besides killing five people and injuring many others. The section of the country involved includes Tonawanda, in New York State, and Merritton, in Ontario, Canada, where the damage was the greatest. In Tonawanda the tornado demolished houses, uprooted trees, overturned freight cars, and swept a clean path several hundred feet wide for a distance of ten miles. Our engraving shows some of the wrecked freight cars at Tonawanda, showing how box and coal cars were wrenched from their trucks and thrown off. Tonawanda is the great center of the lumber industry, so that naturally the damage to the lightly constructed wooden buildings was considerable. Thousands of feet of pine were swept into the river. After passing over Tonawanda, the tornado took a southeasterly course, and visited small towns further on. While crossing from Grand Island to the main shore, the tornado formed a waterspout in the Niagara River fifty feet high. As it swept east it destroyed buildings right and left; telegraph poles were demolished by the thousand.

FREIGHT CARS WRECKED BY A TORNADO AT TONAWANDA, N. Y.

and the boy driving was carried sixty feet and deposited in the street. St. Catharine's also suffered greatly. The cyclone lasted but five minutes at Merritton and its approach was watched by many of the townspeople. Outside of the tornado belt the sun was shining brightly. A cyclone of this nature has never been known in this region before. The cloud, its appearance and its method of working, as well as the devastation which it wrought, are all identical with the cyclone of the West.

THE WORK OF THE CYCLONE AT MERRITTON, CANADA.

As already stated, Merritton was the greatest sufferer by the cyclone. It is a manufacturing town, one and one-half miles from St. Catharine's, Canada, on the Welland Canal. There are two large paper mills and a cotton mill there. The two buildings of the Lincoln paper mill were destroyed. The roof was picked up, the walls were smashed in, and the heavy machinery went tumbling through the floor. Eighty employés were at work, and it was a miracle that only one person was killed. Over $150,000 damage was done to the two buildings of the paper mill. The ward schoolhouse, containing seventy-five pupils, was overthrown; one girl was killed and a score were badly injured. Twenty children were injured in another schoolhouse. "Orange Hall," the local home of the Orangemen, was razed to the ground.

Our engraving shows the terrible destruction of the cyclone. In front are the ruins of Orange Hall, the schoolhouse in which the child was killed is in the background to the left, and the chimney of the Lincoln paper mill is shown to the right. Another engraving shows the house of John Gardner, showing the enormous power possessed by the cyclone, which in a moment turned a substantial house into kindling wood, and also wrecked a brick house. The Presbyterian church was completely destroyed. The spire of the Episcopal church was torn down and the power house of the Acetylene Gas Company was also wrecked. In all twenty buildings at Merritton were destroyed, and it was thought the loss would be $225,000. The cloud took a zigzag course through the town near the paper mill, where there were several cars loaded with paper. They were tossed into the mill race and the air was filled with flying paper. Some bits were picked up five miles from Merritton. At Grantham the storm played several tricks. One house was blown down and a red hot stove picked up and carried across the road. A baker's wagon at Merritton was picked up

The Telephone Kite.

According to the journal Electricity some recent experiments have been made in England, in which a kite was made to support a telephone wire. Apparently the middle of the wire was fastened near the kite, which was flown from a ship, as if at sea. One end of the telephone wire remained on the ship, the other was dragged by the kite a long distance to leeward until it was without difficulty dropped on the deck of H. M. S. "Dauntless," where it was secured and attached to a telephone apparatus. In this way vessels that are perhaps two miles apart can be brought into telephonic communication, and when no longer needed, the kite and telephone wire are reeled back to the first vessel without any loss. In the present case the experiment lasted four hours, during which time the kite remained suspended, held in place by the two wires and communication between the two vessels was uninterrupted.

It would seem that such a method of communicating between the shore and a vessel to windward wrecked in the breakers would sometimes be as useful as the Francis life-saving apparatus. The kite telephone, so called, would prove especially valuable at nighttime. The same method would seem to be as practicable for carrying a telephone wire over a difficult country or forest as over the ocean, and probably as useful in war times as in time of peace.

Rats in the Azores.

A resident of Fayal, says the Revue Scientifique, complains of the abundance of rats and rabbits. The rats multiply fast, and make all sorts of depredations, not only within houses, but in the fields and gardens. They attack a great number of edible fruits, such as bananas, oranges, and grapes; they infest granaries, houses, and fields. Among other depredations, the rabbits have attacked a field of tea plants, and of 4,000 vigorous shoots that were set out by the proprietor, they have destroyed 3,988 completely, leaving him 12 by way of consolation. The farmers are beginning to ask what they shall do. Shall they import the mongoose? The example of Jamaica makes them hesitate. And still another example in the Azores is of a kind to render them cautious in matters of acclimatation. The pigs there have been allowed to run wild and live in a state of freedom; the result is that imported partridges have almost entirely disappeared, the young having been eaten by the swine. It is thus difficult to tell what to do, and meanwhile rats and rabbits are abandoning themselves to all sorts of excesses.

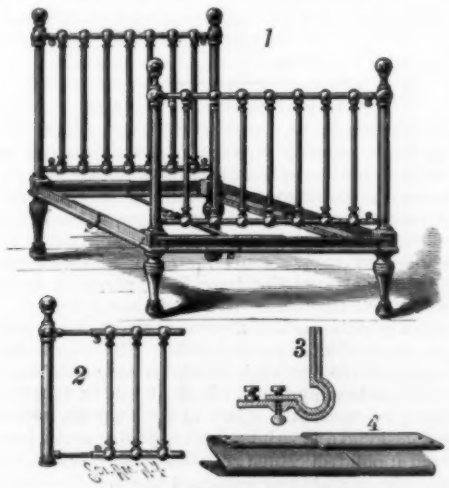
HOUSE COMPLETELY WRECKED BY A CYCLONE AT MERRITTON, CANADA.

Cross Lighting.

Some traditions die hard, being accepted without examination by nine persons out of ten and by all who are in or under authority and, like officials generally, opposed to, or suspicious of, innovation. Among these is the belief in the hurtfulness of cross lighting. This method of lighting would seem only to be held injurious in schools, for in our own houses we are only too pleased if we can have windows on two or more sides of a room. Even in Germany, where statistics and experimental investigation pervade every department of administration, and where in each detail the executive is guided by an order in council somewhat inappropriately called an "Erlass," we find cross or double lighting still expressly condemned. Yet Cohn and Förster, Javal and Ferrand, Rumbold and a Royal Commission on School Construction have urged the groundless nature of the prejudice. Provided always that the eyes are not dazzled and that no shadow falls on the reading or writing, it is impossible to have too much diffused daylight or its artificial equivalent. The loss of intensity with increasing obliquity of the rays of light is acutely felt in wide rooms, especially when not high in proportion, on the side opposite the windows; whereas if there be windows or lights on each side, the intensity of illumination is equalized and its total amount doubled. It is only necessary that that coming from the right should be naturally or artificially the weaker, as by having the windows north and south or by filling those on the right with clouded glass. Windows in front are always objectionable, but light from behind, if not so strong as to cast a shadow, can but serve to increase the illumination derived from the proper quarter. As Cohn and Förster long since pointed out, reading or other work demanding clear but effortless vision is in the open air when the sky is overcast a real luxury. Under these circumstances the light is ample but shadowless; it comes from everywhere, but from no one quarter more than from another. The most perfect artificial illumination conceivable is that obtained by Hrabowski's arrangement of hemispherical milk glass reflectors with prisms and mirrors by which the light of an electric arc lamp is diffused equally throughout the building, though the source is hidden from view. The light is photometrically equal to that of a clear summer day and as free from color; it is almost shadowless and is, in fact, superior to daylight in not being liable to fluctuations, although its intensity can be regulated at will.—London Lancet.

A NEW EXTENSION BED.

An extension bed has been patented by Alfred W. Furnival and Henry Martin, of Second Avenue, Astoria, N. Y., which may be adjusted in length and width to meet various requirements. With this object in view, the side and end rails are made in two parts adapted to slide one upon the other. As indicated in the cross section in Fig. 3, these rails are constructed of plates so bent as to form vertical and horizontal flanges which are united by a bulb. The rail sections may slide longitudinally, but are prevented from being laterally displaced by the peculiar construction of the bulb. By means of a screw, the two parts of each rail may be held in any desired position. To the rails corner-blocks are secured and provided with legs. Corner-posts are carried by the blocks and have adjustable connection with the head and foot pieces. As shown in Fig. 2, the head and foot pieces are composed of hor-



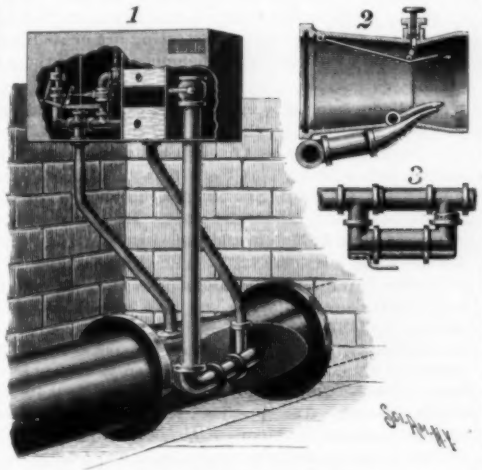
A NEW EXTENSION BED.

izontal tubes and vertical connecting rods. The horizontal tubes slide over rods fixed to the corner posts and are held in any desired position by means of screws. The springs for this bed are shown in perspective in Fig. 4. These consist of reversely curved plates adjustable longitudinally and rolled over or beaded to prevent lateral displacement. The springs are held within the bed by means of holes engaging pins on the side rails, and are supported at their central portions by means of a rod made of telescoping sections and extending between the end rails.

Among the many advantages claimed for this bed are its structural firmness and its ready adjustability to conform with the accommodations afforded by various rooms. The construction of the springs is noteworthy for the novel means employed to prevent sagging of the central portions.

AN APPARATUS FOR PURIFYING WATER.

The methods usually employed in purifying water require costly pumping and filtering stations and



McELROY'S APPARATUS FOR PURIFYING WATER.

special machinery. It is the purpose of an invention patented by the designing engineer of the Brooklyn Water Works, Mr. Samuel McElroy, 170 Broadway, New York, to supersede these expensive appliances by providing an apparatus in which the force of gravity becomes the agent of applying air or antiseptic solutions to the water running in a conduit.

In the line of the conduit the inventor places the induction valve shown in Fig. 2, the casing of which is contracted between its ends, so as to produce an increased velocity of water in the throat thus formed. This valve is further provided with inlets for the entrance of air and of antiseptic gases or solutions, and with a deflecting plate adjusted by a screw rod to promote the increased velocity of the water. A casing, as shown in Fig. 1, is placed near the induction valve and is provided with an air chamber properly connected with an inlet to the induction valve and with a check or stop valve to guard against reactions. The casing is furthermore provided with a solution chamber and with a mixing chamber also connected with the induction valve and guarded by proper check and stop valves. The solution and mixing chambers supply the antiseptic gases as they are required. A roil pipe is applied to the conduit as shown in Fig. 3, for the purpose of collecting the organic matter with which the water may be impregnated.

In operation the water flowing through the conduit will produce a draft which draws through their respective pipes the air from the air chamber in the casing and the antiseptic solutions stored in the solution chamber. The impurities of the water coming into contact with these corrective agents will be destroyed or neutralized.

Among the advantages claimed for this apparatus are its automatic action and its cheapness.

The Slime on Fishes.

A fish just taken from the water, if handled, says The New York Sun, is found to be slippery and coated with slime. All fishes, the meanest and the noblest, killi-fish and shark, shad, salmon, and trout, wear this slime. They could not exist without it.

The slime is secreted usually in a continuous series of ducts with numerous openings, arranged in a line extending along the side of the fish. Some fishes have one line on a side, some have five or six. The lines may be plainly visible, and in some cases appear to be a marking on the fish. More often they are not observable at all. Some fishes store this secretion in pores distributed over the whole surface of the body, the larger number, however, in pores in lateral lines. There are also pores for the secretion of mucus or slime in a fish's head.

The slime is exuded through the divisions between the scales to the outer part of the body, over which it spreads, forming a sort of outer skin or covering, transparent, and having elasticity and tenacity, and often considerable body. It would not be remarkable for a fair sized fish, say a fish of two pounds weight, to have a coating of slime a thirty-second of an inch in thickness. Fishes vary greatly in the amount of slime which they secrete; the eel will suggest itself as one that is very slimy.

The fish's slimy coating reduces its friction when in motion and helps to increase its speed. It aids in protecting the scales from injury, being of sufficient substance to serve in some measure as a cushion. The slimy covering makes the fish hard to hold, and so enables it the more readily to escape from its enemies. It is sometimes repugnant to other fishes, which are repelled by its odor. It is the slime from the fishes handled that makes the angler "smell fishy" as the expression goes.

A most important function of the fish's slimy coating is to protect it from the attacks of fungus, a form of plant life found in all waters, salt and fresh, including the purest. The slime covers the entire exterior surface of the fish, including the fins. Fungus does not attach to the slime; but if the fish were to be injured so that there was upon it some spot uncovered by the slime, upon that spot some minute fragment of fungus, so small as to be scarcely more than visible, would be likely to lodge. Once lodged, the fungus is reproduced very fast.

Fish sometimes recover from attacks of fungus, but much more often they do not. The fungus displaces the skin, inflammation is set up, and the place attacked becomes practically a sore. With its continued growth the fungus may cover the side of the fish and extend over the gills and finally kill it.

THE "SENTINEL" BICYCLE-LOCK.

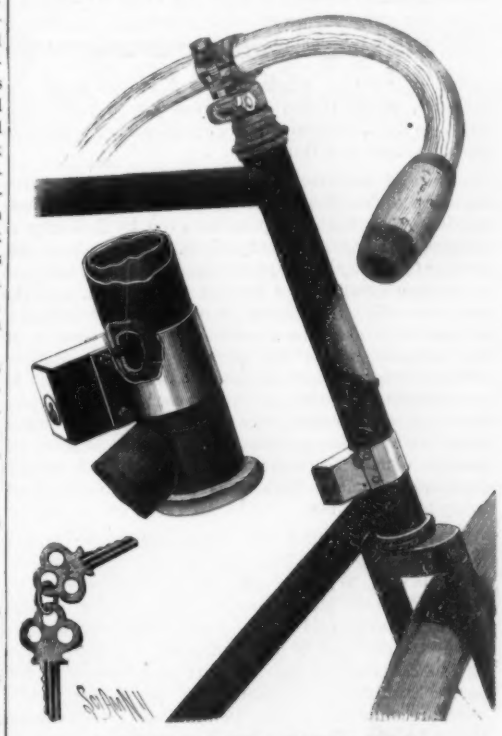
An ingenious bicycle-lock, which will no doubt find very general favor with wheelmen, is now being introduced by the Yale & Towne Manufacturing Company, of No. 9 Murray Street, New York.

The lock, as shown in the illustration, is intended to be permanently fastened to the steering-head of a bicycle, and is designed to hold the front wheel at an angle to the frame, thus rendering it impossible for the bicycle either to be led or ridden away.

The locking mechanism is that of the well known Yale pin-tumbler type, which makes the number of key changes practically limitless, thus absolutely precluding the possibility of other keys being in existence which may fit the lock.

We learn from the manufacturers that, during the past summer, a number of these locks have been in use by riders, and that it is their unanimous testimony that they are of the greatest service.

The lock is of neat design and finish, and, to quote one rider, "no better insurance can be put on a wheel."



THE "SENTINEL" BICYCLE-LOCK.

It is thought that it will be extensively placed on bicycles by manufacturers, as a special feature for the coming season; but it may be easily applied to any wheel. While shown in the present cut attached to the head with a separate band, it may also be used directly behind the name plate; the latter being employed as a band to secure it to the wheel.

We hear that one of the largest bicycle manufacturers in the country, having an extensive export trade, has undertaken to introduce the lock throughout Europe.

A VELOCITY of 8·3 or 10·6 kilometers per second is obtained for the wave front of the Indian earthquake of June 12, 1897, the two values being obtained by means of the two times recorded for the start of the earthquake at Calcutta. The velocity of the propagation of the maximum inclination of the earth's surface to the vertical comes out 2·61 or 2·76 kilometers per second.—G. Agamennone, in Science Abstracts.

Science Notes.

An alcohol thermometer 70 feet in length is now being put in place at Winchester, Mass. It will be placed in a pit of its own depth and be used for scientific measurements of the earth's temperature. It is constructed on the same principles as smaller instruments.

The great telescope for the Paris Exhibition of 1900 is said to be making good progress, and it is expected that a magnifying power of 10,000 will be used on occasions, but 6,000 will be the normal. The aperture will be 1¼ meters, or nearly 49¼ inches, the focal length being nearly 197 feet.

The French Société d'Encouragement has awarded the grand prize of 12,000 francs to M. Moissan for his numerous researches in chemistry; the prize of 2,000 francs for the experimental study of the properties of metals and alloys to M. C. E. Guillaume; and an encouragement of 500 francs to M. Capredon for his work on metallurgical chemistry.

The hypothesis is put forward by H. V. Gill, in The American Journal of Science, that the stratification of the electric discharge in Geissler tubes is due to gas-waves somewhat analogous to those which produce the dust figures in a Kundt's tube. This theory is supported by dust figures obtained by electric discharges at various pressures of gas.

The employment of individual glass jars for the retention of milk delivered by peddlers has been prohibited by milk inspectors in several cities, on the ground that they are dangerous to public health. The objection is advanced that their sterilization is impossible, as water of the requisite temperature to destroy germs would break the jars. Safety is only insured by the use of receptacles that can be subjected to steam heat. The glass jar has been tabooed at the West Point Military Academy, and should be generally abolished, and especially its pasteboard overlid.—Phil. Med. Jour., August 13.

A chronograph has, says the Deutsche Uhrmacher Zeitung, been invented which is said to excel by far all former achievements in this field, and to admit of measuring one millionth part of a second and even smaller spaces of time. The apparatus is based on the following principle: At the end of a tuning fork of a very high number of vibrations a hole is provided, through which a pencil of rays falls upon the case of a revolving cylinder whose circumferential velocity is thirty meters per second. In consequence of the quick vibration of the tuning fork and the rotation of the cylinder, the said luminous tuft describes upon the cylinder, which is doubtless covered with paper sensitive to light, a curve whose dimensions correspond to certain particles of time.

In one of the streets in the neighborhood of the famous London Bridge there has for some time been carried on an industry peculiar even to that city of curious and crowded occupations, namely, an eelskin leather factory. Here are prepared and manufactured an interesting variety of articles from the skin of the common eel. By means of numerous complicated processes the skins in question are manipulated until they resemble and would be easily taken for leather, although of a more glutinous and pliable nature. In one specialty this strange substance is cut into long, thin strips and plaited very closely together for whiplashes and to cover portions of the handles of more expensive whips. Certain kinds of lashes and harness laces are also made from such skins, combining flexibility and toughness.

The following fluids are recommended by Amann for preserving biological specimens: Lactophenol: Carbolic acid, 20; lactic acid, 20; glycerin, 40; distilled water, 20 parts. Recommended for fronds of mosses, hepaticæ, fungi, and algæ. Lactophenol copper solution: Crystallized copper chloride, 0·2 part; crystallized acetate of copper, 0·2 part; distilled water, 95·0 parts; lactophenol, 5·0 parts. For preserving chlorophyl, recommended for Demidiaceæ, Palmadaceæ, Confervæ, etc. Concentrated lactophenol copper solution: Crystallized copper chloride, 2·0 parts; crystallized copper acetate, 2·0 parts; lactophenol, 95·0 parts; water containing algæ is mixed with 10 per cent of the above solution. The whole material is preserved thereby for a long time. Lactophenol glycerin jelly: White gelatin, 85; distilled water, 44; glycerin, 30; dissolve by heating on the water-bath, filter and mix with 10 parts of lactophenol. Lactophenol copper glycerin jelly: Prepared as above, with the substitution of 10 parts of lactophenol copper for lactophenol. Phyocyanin and chlorophyl retain their color excellently in this medium. Lactophenol gum: A strong solution of gum arabic in water 1, glucose 2, and lactophenol. For preparing mosses for the herbarium. Potassium mercuric iodide glycerin: The author states that the salt dissolved in concentrated anhydrous glycerin gives a mounting medium of 1·78 to 1·80 refraction index. He recommends the mixture for Diatomaceæ. The preparations are ringed on with amber or dammar varnish mixed with 2 per cent of boiled linseed oil.—Pharm. Centr., xxxviii., 544.

Miscellaneous Notes and Receipts.

Remedy for Bee Stings.—It is reported from France that the juice freshly expressed from poppy stems, if promptly applied on bees' stings, will immediately alleviate the pain and not allow an inflammation to occur.

Simple fire-extinguishers can be produced by anybody at a slight cost, says Technische Berichte. Dissolve 20 pounds of common salt and 10 pounds of sal-ammoniac in 30 liters of water and fill the mixture in quart bottles of thin glass. The extinguishers thus prepared are highly suitable to smother small fires. The bottles, which should be securely corked up and sealed, to prevent the contents from evaporating, are thrown into the flames of the starting fire or its immediate vicinity with enough vehemence to cause them to break.

A Balloon Trip Over the Swiss Alps.—The bold project long cherished by the well known aeronaut Spelterini to cross the Swiss Alps in a balloon is soon to be carried into effect. The Paris firm of Bésançon has constructed for Capt. Spelterini a balloon whose size surpasses that of all former ones. Its circumference is no less than 58 meters and the surface 1,065 square meters, while the contents is 8,768 cubic meters. The network surrounding the balloon is capable of sustaining 110,000 kilos, while the car lifts 76,000 kilos. The air ship weighs 1,000 kilos. The total rising power of the balloon, which is filled with hydrogen gas, is 3,700 meters; 2,000 kilos of ballast is taken along in sand bags. The weight of the passengers and their instruments is estimated at 400 kilos. The best silk stuff was used as material, 6,386 single pieces of silk being employed, whose seams have a total length of 4,440 meters. Everything is made as air tight as possible by repeated varnishing.

The expedition, which will be joined by the well known Swiss geologist, Prof. Heim, of Zurich, and a representative of the meteorological central station at Zurich, is a scientific one. The greatest attention has been paid to procure the best instruments required for the various scientific observations, so that reliable results may be looked forward to with certainty. The giant balloon, which bears the name of "Wega," has been exhibited from September 4 to September 13, at Zurich, whence it was taken to Sitten, in the Rhone Valley, from which place the ascent is to take place. There the last preparations are made for the project, which is as interesting as it is audacious, and the favorable moment for the ascent is awaited. This will take place as soon as favorable weather reports are received from the meteorological central station at Zurich and small trial balloons have demonstrated the presence of the suitable wind direction.—Staats Zeitung.

What is the Best Time to Take Medicine?—According to the Leipziger Drogisten Zeitung, Dr. E. Vogt gives in the Revue de Thérapie the following elucidations on the most suitable time for taking medicine. Most medicine can be taken any time on an empty stomach, before or after meals. But if an irritating substance is introduced into the stomach, it is important that it be not in too small a volume. If such a body is soluble in water, a highly diluted solution is given; if it is insoluble, it is given with the meal. The form of the drugs is also of importance. Thus hard pills, taken on an empty stomach, may irritate; likewise wafer capsules, whose contents first spread over a limited space in the stomach. But if such capsules, e. g., sodium salicylate, are given with the meal, the contents mix at once with the food and cannot cause any local irritation of the mucous membrane of the stomach. If, however, a prompt action is desired, the medicament is given on an empty stomach, but always diluted, because it is very sensitive to strong solutions. Many have an impeding or retarding action on the digestion, e. g., chloroform, naphthol, saccharin, etc.; therefore it is of importance to administer them when the process of digestion is past or almost so. In this category fall the metal salts, the iodides and bromides, which should be taken with plenty of water on an empty stomach early in the morning or late at night. Mercury salts irritate the mucous membrane of the stomach; therefore they are given in a diluted solution on an empty stomach early in the morning. The author cannot believe that calomel with cooking salt might partly become transposed into sublimate; at any rate, no accidents need to be apprehended from this source. Otherwise strict observation should guard against mistakes. A glass of quinine wine given before the meal causes a slight alcoholic stimulation in the stomach of a child, and one should be careful not to take this for the strengthening effect of the quinine. Therefore, it is better to give such wines after meals. Bitters should be taken the moment one sits down at table, not half an hour before the meal. It is imprudent to administer cod liver oil before the meal. Why coat the stomach with oil whose walls are expected to exercise an assimilating action? For that reason cod liver oil is given after eating or at least an hour before. Sodium bicarbonate taken before the meal causes too large a secretion of gastric juice. After eating it blunts the excess of acid.

Nickel and Aluminum Coins.

The Secretary of the Treasury will soon order the Philadelphia mint to resume experiments in the use of alloys in the five cent and one cent pieces, says The Washington Star. This will be done under a House resolution. The test will be to determine whether it is advisable to substitute pure nickel in these coins in place of the alloys now used. The Swiss and Italian governments use pure nickel in their minor coins, and they have proved satisfactory. Pure nickel is much harder than the alloy now used, and, it is said, would not abrade so quickly. Whether it would retain the color better must be determined, but those competent to judge are of the opinion that coins of pure nickel, after being in circulation for a short period, could not be distinguished from the present five cent piece. It is also thought the nickel coins would be more difficult to counterfeit, one reason being that they are highly magnetic, and another that the cost to the counterfeiter would be much greater than now.

The present alloy of the five cent piece is 25 per cent nickel and 75 per cent copper. Under the new process there would be about 94 per cent nickel in the coin. The two cent pieces have 95 per cent copper and 5 per cent of tin and zinc.

Experiments are also to be made with aluminum. Heretofore these experiments have failed to produce results. The last experiments were made early this year. Prior to that the last experiments were in 1864.

In 1863 the director of the mint called the attention of the Treasury Department to the propriety of substituting coins manufactured of aluminum of the denomination of five and ten cents, to take the place of the fractional notes of these denominations in circulation at that time. In 1864 a number of experiments were made with an aluminum alloy containing 99 per cent of silver and one of aluminum, with a view to ascertaining the fitness of the same for coins of the denomination of five and ten cents. The alloy, however, did not work satisfactorily, as it was found that it not only discolored rapidly, but was difficult to work.

An alloy of thirteen parts copper and one of aluminum was also tried, as well as another of nineteen parts copper and one of aluminum.

These two alloys gave the coins a gold color, and the metal was found to be very hard, and it was difficult to procure perfect impressions.

At the request of the National Academy of Science and by direction of the Secretary of the Treasury, a number of other experiments were made in 1864 with aluminum, under the auspices of Dr. John Torrey, Prof. Bache, Prof. Henry, Dr. Barnard, and Prof. Gibbs, members of the academy. For this purpose a bar of alloyed aluminum was furnished, which upon assay was found to contain nine parts of copper and one of aluminum. These experiments were made with a view of ascertaining the adaptability of aluminum alloys for coinage purposes, also to test the tenacity of the same as compared with copper. The composition was found to be very rigid under the rolls, requiring many annealings, and proved very refractory in working, so much so that perfect impressions of the coins were not obtained.

No further experiments were made after this date with aluminum alloy for coinage purposes until the experimental pieces called for by the resolution were struck.

The Austrian government makes its minor coins of 97·37 per cent nickel, 1·30 cobalt, 0·32 copper, 0·80 iron, 0·14 silicium, and 0·07 carbon. Too much cobalt darkens the color, and an excess of iron and carbon makes the metal too brittle.

Improvements in Santiago.

Capt. Brady, of the United States Signal Corps, has been ordered to begin the construction of an overland telephone line 320 miles in length, from Guantanamo to Santiago and Manzanillo. The present cost of transmitting messages by telegraph from Guantanamo to Santiago is twenty cents a word up to thirty words and twelve cents for each additional word. Educational statistics have been prepared by Gen. Wood, and they show that forty-one per cent of the white population and twelve per cent of the colored people are able to read and write. The schools were to be opened the first week in October and attendance was to be made compulsory. English will be taught, and thirty teachers, at a salary of $60 a month, have been engaged and a superintendent, at $125 a month, has also been appointed. Much gratification has been expressed over the law-abiding nature of the people in the province, as there has been no murder since the occupation of the Americans, and the few crimes which have been committed are all of a petty nature. The city of Santiago is being put in an excellent sanitary condition.

AN observatory on Pike's Peak is to be built by the Manitou and Pike's Peak Cog Railway Company, and the contract has been signed for the construction of the tower. It is proposed to mount in this tower four powerful telescopes for the benefit of visitors.

Correspondence.

The Largest Floating Dock.

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of your valuable paper of September 24, you publish an article under the heading "The Largest Floating Dock in the World," accompanied by an illustration of the new pontoon dock of the Vulcan Company, of Stettin, Germany, the dock you have reference to.

Permit me to say that this is not correct, as there is a still larger floating dock in existence, namely, the one built by Messrs. Blohm & Voss, Hamburg, Germany, which has been in use at their yard for over a year and a half.

In comparing the capacities of these two docks, you will at once notice the considerable difference in favor of the Blohm & Voss dock, the dimensions of which are as follows:

Length	560 feet.
Breadth	88 "
Depth over sill	80 "
Draught of water	47 "
Freeboard	4 "
Lifting power	17,500 tons.
Time for lifting maximum load	1 hour.

Such steamers as the "Pennsylvania" and "Pretoria" have been lifted by this dock.

New York, September 28, 1898. C. P. O'SWALD.

Collectors for Wimshurst Machines.

To the Editor of the SCIENTIFIC AMERICAN:

Much as has been written concerning the Wimshurst machine and its several parts, the subject of collectors seems to be neglected.

For machines with sectors, the ordinary U-shaped collecting combs with numerous points seem to serve as well as any other form, but with sectorless machines there is a wider field open to research.

Some nine months ago two Wimshurst machines were built for experimental work, which have been in use almost ever since, one being made by myself and the other by Homer Bretz, an amateur electrician, of this city. My machine had two varnished plates of window glass 14 inches in diameter and $\frac{1}{8}$ inch apart. The other machine had two similar plates, being different only in size, as they were 13½ inches across and $\frac{3}{16}$ of an inch apart. Both are of the uninclosed type, and were designed especially for experiments with the brushes and collectors. The 14-inch machine had sectors and the common U form of collectors. The Leyden jars were small in comparison with the size of the plates, being designed to give short sparks quickly following one another. The other machine was sectorless and had larger condensers, the sparks being larger and at greater intervals of time.

The sectors were removed from the 14-inch machine soon after completion, and the output of current was slightly increased in consequence. The collectors were next removed and a single point for each pole was presented to the face of the front plate, with a result that the output was still further increased, a 4-inch spark being readily obtained.

On the smaller machine the collectors were also removed and a thin steel wire, about 1¼ inches long, was inserted between the plates at the place where the combs had been, and each wire was connected to the discharge rod at its own side of the machine. The result was past all expectations. A 6-inch spark was readily obtained, and they followed each other across the air between the discharging rods fully as fast as the 4-inch spark had formerly done.

My machine was again changed to the interplate collector, with equally satisfactory results. On account of the design of the machine, 4½ inches is about the limit of the length of the spark, but with the present collector the rate of discharge is greatly increased.

A sectored machine was tried with the interplate collector, with but little change in the length of the spark, as compared with that obtained from combs.

Later a Wimshurst machine with vulcanite plates was stripped of its sectors and provided with collecting rods placed between its plates, but it failed to excite. The strongest argument in favor of the interplate collector, aside from its high efficiency, is its extreme simplicity.

In a number of experiments on different machines, under widely varying conditions of weather, this form of collector proved its superiority over the comb collector. DAN MCNAUGHTON.

Charlotte, Mich., September 23, 1898.

AT the recent meeting of the Association Française pour l'Avancement des Sciences, M. P. Villard presented a communication upon the regenerative action of light on fluorescent screens of platinocyanide of barium. It is well known that when these screens are exposed for a long time to the action of X rays, the salt darkens in color and the fluorescence of the screen diminishes. According to M. Villard, an exposure of the screen to direct sunlight for fifteen or twenty minutes completely restores its properties. The infra-red rays in sunlight seem to be the most active in the work of regeneration. A practical suggestion is that such screens should be kept exposed to daylight, their properties being thus indefinitely preserved.

The Gondola: Its History and Manufacture.

In Mr. Horatio F. Brown's "Life on the Lagoons" there is an interesting account of the history and manufacture of the gondola, from which we condense the following:

The earliest authentic document relating to Venice is a letter by the secretary of Theodoric, in which is noted the light boats which were used by the Venetians, and which were tied like horses at the doors of their houses. It is certain that the early boats were unlike the modern gondola, and this word does not occur until the twelfth century, and its derivation is still an open question. It is generally believed, however, that it is derived indirectly from the Latin and Greek names for the boat in which Charon ferried souls across the Styx. To this day the passenger across a Venetian ferry lays his "obol" on a gunwale of the gondola, much as Charon's ghostly fares were wont to do. The earliest pictures of the gondola, or rather its immediate predecessor, date from the fifteenth century only. The next two centuries, the sixteenth and seventeenth, were the great period of Venetian magnificence and pomp, and the gondolas shared in the movement. For this period we have abundant evidence in the pictures in the Academy and in the Ducal Palace. The paintings of Gentile Bellini and Carpaccio contain many excellent views of gondolas of the time, and from them we see that the period of sumptuous development of the gondola was about to begin. The boats were covered with fine stuffs, embroidered in patterns of bright colors, and were open on the sides, giving shelter at the top only. The adornment of the canopy was the point of departure for the excessive luxury which gave rise to sumptuary laws. At the close of the sixteenth century the form of the gondola underwent a great change and approximated its present construction. The massive steel "ferro," or prow, which is, perhaps, its most striking feature, was added at this time. Various reasons have been suggested to explain the adoption of the "ferro," but the matter has never been satisfactorily cleared up. It is said by some that the "ferro" was introduced as a measure, in order to allow a gondolier to judge whether he could pass under any particular bridge. If the "ferro" passed, he knew that the gondola with its canopy could also go under without striking. Others maintain that the "ferro" at the bow acted as a counterweight to the rower behind, but this theory is destroyed by the fact that the earliest "ferri" were attached to both bow and stern. It is probable that the "ferri" were added for adornment and nothing more. The "felze," or canopy, became richer and richer, which caused the sumptuary magistrates to issue many decrees against them. Finally the use of color was tabooed and only coarse black woolen stuff was allowed; all carving and gilding were forbidden, and all of the metal work had to be perfectly plain. The government experienced the greatest difficulty in enforcing these regulations, for the nobles had a mania for display. One result of these laws remains to this day in the somber black which universally characterizes the gondola. Foreign ambassadors were alone exempt from the stringent decrees against color and decoration, and they availed themselves of their privilege to a remarkable extent. In the eighteenth century the gondola underwent its final modification and assumed the form which it now possesses. The ferro at the stern disappeared, and that on the bow was broadened into the hatchet head of the modern gondola which we know so well. The vessel was lengthened to gain speed, and the "felze" received its door and glass windows. In short, the type of gondola was fixed by the year 1740.

The trade of making, cleaning, and repairing the gondolas is active in Venice, and it is very easy to visit their open sheds and yards on the border of the city. In front of the shed a long slope leads down to the water's edge. This is well plastered with mud so as not to injure the boats when they are drawn up or lowered into the canal. A pitch pot is usually burning in one corner, and the men move about swabbing on the pitch and drying the same by burning piles of loose straw beneath the boats. The first thing to be done in building a gondola is to choose the wood of which the boat is to be made. It must be well seasoned and free from knots. These points are more essential in the gondola than in the case of other boats, for the planks of which they are made are so thin that they are liable to warp and the knots to become loosened and start.

When the wood has been chosen, the builder begins to lay down the gondola; four posts determine the length and width. The operation of building begins by setting up the stern and bow posts; which are made of oak. The ribs, of walnut, cherry, or elm, are then laid down. They are flat at the bottom, for the gondola is a flat-bottom boat, and the rounded uppermost ends of the ribs are joined together by a binder of oak. At the points where the bow and stern decks are to begin, two bands of walnut, rising in the middle, run across the boat from one binder to the other and act as a counter support to the ribs, which may otherwise be pressed in by the strength of the binder. When this is finished, the hull of the gondola, as far as its strength and structure lies, is complete. It remains to add the walls of pine and the bottom, which is likewise of pine. The floor rests upon ribs and protects the bottom, which is too delicate to bear treading upon without danger of starting. The deck used to be made of walnut, but now pine is usually used. The deck is divided into four compartments on each side by thin strips of carved or beaded wood. A little door closes the deck in front and makes the boat a safe place for the storing of the gondolier's possessions. Two steps in the bow permit of an easy embarkation or landing. The rowlocks and the foot rests are added, and here the gondola builder ceases his labors. The rest of the fittings are bought elsewhere. So far the gondola will have cost about $60.

The iron finishings for the bow and the stern are then bargained for at some smith's shop and made separately. Every part of the beak of the bow has its own name. Unfortunately, hand labor is being superseded in Venice, as elsewhere, and the handsome wrought iron ferros have given place very largely to cast iron substitutes, which are heavy and brittle, but the profession of a gondolier is in most cases hereditary, so that an old ferro is possessed by almost every family. The price of the "ferri" for the bow and stern is about $20, which brings the cost of the boat up to $80.

The boat is now ready to navigate the canals, but in order to fit it to carry passengers, the "felze," or little house in which the passengers sit secure from wind and rain, must be added. The mountings of the "felze" are of brass, and the cost of the whole is not far from $100; so that it is seen that the boat is rapidly increasing in expense. The "tenda," or summer awning, is a modern device, and is quite popular with tourists, but the more conservative among the Venetian families are slow to adopt it. The carpet, cushions, and the arm rests must be added to the cost, which amounts to about $40, so that the entire cost of a new gondola is not far from $220. The young gondolier just starting in life is not likely to have such a sum by him; so the practice is to pay down a certain amount at once and to discharge the remainder in monthly or quarterly payments.

When the gondola is new, it is left unpainted on the outside for the first year, as an intimation of its use and also as a sort of guarantee to any possible purchaser, for the value of the gondola falls immediately after it is painted, for then it is impossible to ascertain the condition of the wood and the presence and absence of knots.

The gondoliers soon become devotedly attached to their boats, and they study their character and peculiarities; for it is a strange fact about this most extraordinary of boats that it has a character and temperament of its own, in spite of the fact that the boats are all built on the same model; and much of the gondolier's skill in rowing depends upon his knowledge of his boat. He spends hours every day in sponging, scrubbing, and drying his boat, and he soon knows every nail in its hull and every scratch upon its steel or brass. Mr. Brown tells of a gondolier who identified, swore to, and recovered a pair of sea horses, which formed a part of the ornamentation of his boat and which had been stolen from him, on the strength of certain almost invisible scratches, which had escaped the notice of the thief.

With so much uncovered metal in the fittings of the gondola, it is, of course, necessary to keep these metals in a high state of polish, which occupies all the spare time of the gondolier. It may truly be said that the gondolier is known by his boat, and those who have lived for a long time in Venice are sure to glance at the "ferro" before picking out a boat, as this tends very largely to show the ability of the boatmen. Once every three months in the winter, and once every twenty days in the summer, the gondola must be hauled on shore, scrubbed, dried, and plentifully anointed with grease. This operation makes a surprising difference in the speed of the boat. The process of cleaning occupies a whole day, so that the gondolier not only loses a day's fares but has also to pay about 80 cents, which is a considerable tax upon him, considering the extreme smallness of the fare which he is allowed by law to collect.

If the gondolier attends properly to his boat, it will last in excellent order for at least five years. At the end of that time he can sell the hull for $20, and then take the rest of the fittings for a new boat, while the old gondola finds its way to one of the least frequented ferries, where it will do duty for another five years. It gradually loses its graceful curves and form as the woodwork fails, until at length it becomes a "gobbo," with its bows no longer sweeping up in a proud curve, but buried in the water; then its day is over. It is fit for nothing but to be sold, broken up, and burned in the glass furnace of Murano, the crematory of most ancient gondolas.

THE OMAHA EXPOSITION AND THE INDIAN CONGRESS.

The Exposition at Omaha is a rare creation and is an unqualified success from every point of view. If one were to be asked what was the most interesting and beautiful feature of the Exposition, he would undoubtedly reply, "The electrical display at night." The lighting of the Exposition is a great advance over that of the World's Fair, and it is a significant fact that France has sent over experts to view the systems of lighting which have been adopted on the Grand Court at Omaha. One of our engravings represents the fireworks display on the grand plaza. It is doubtful if a more artistic display could be devised than that shown in our engraving. It is only another proof of the great success which pyrotechnic art has attained in America. Our other engraving represents a group of five Indian chiefs.

Photograph by F. A. Rinehart. FIREWORKS, GRAND PLAZA, TRANSMISSISSIPPI EXPOSITION.

The attractiveness of the Exposition has been enhanced by the addition of a new feature. This is the Indian Congress, which is organized with a view to assembling the representatives of every tribe of Indians on this continent, and that idea inspired the Indian Bureau at Washington to avail itself of this rare chance to present an ethnological exhibit never before attempted, and it is not likely that such a representative collection of Indians can ever be gathered again. Congress appropriated $40,000 for a great Indian encampment at the Transmississippi Exposition. It was entirely a case of persuasion, for the Indians were not coerced into going to Omaha, but, having once reached that city, they seemed to understand what the Indian congress really meant, and are satisfied and happy. The agents were instructed to send old men, and, as far as possible, "head men," who would typically represent the old-time Indian, subdued, it is true, but otherwise uninfluenced by the government system of civilization. These instructions were faithfully followed, and as a result the Indian congress is composed of hundreds of the best types of the various tribes. All of the tribes that are of any interest from an aboriginal standpoint are represented at the congress. Some of them have become so civilized, like the Creeks, Choctaws, Cherokees, and Seminoles, that their presence would add little interest from an ethnological point of view; so the government did not assemble its most civilized proteges at Omaha, but the tribes it has conquered with the greatest amount of bloodshed are the most important at the congress.

When the congress was formally opened on August 4 thirty-five tribes were encamped on the grounds, aggregating about five hundred Indians. The northwest corner of the extensive Exposition grounds were given up exclusively to the big Indian camp. There they are living in primitive style, housed in tepees of tent cloth or birch bark or rush mat wicknips. In some cases the tepees are made of buffalo skins.

The object of the congress is to truly represent the different Indian tribes and their primitive modes of living; to reproduce their old dances and games; show their manner of dress; illustrate their superstitions, and to recall, as far as possible, their almost forgotten traditions. They also have an opportunity to prove their skill in embroidery, basket weaving, and, most important of all, the congress affords an opportunity of comparing the various Indian tribes, to study their characteristics and tribal traits. When told, before coming to the congress, that they would meet other

Four Bulls, Assiniboin. Antoine Moise, Flathead. Different Cloud, Assiniboin. "Kills the Spotted Horse," Assiniboin. Enos Michel, Flathead.

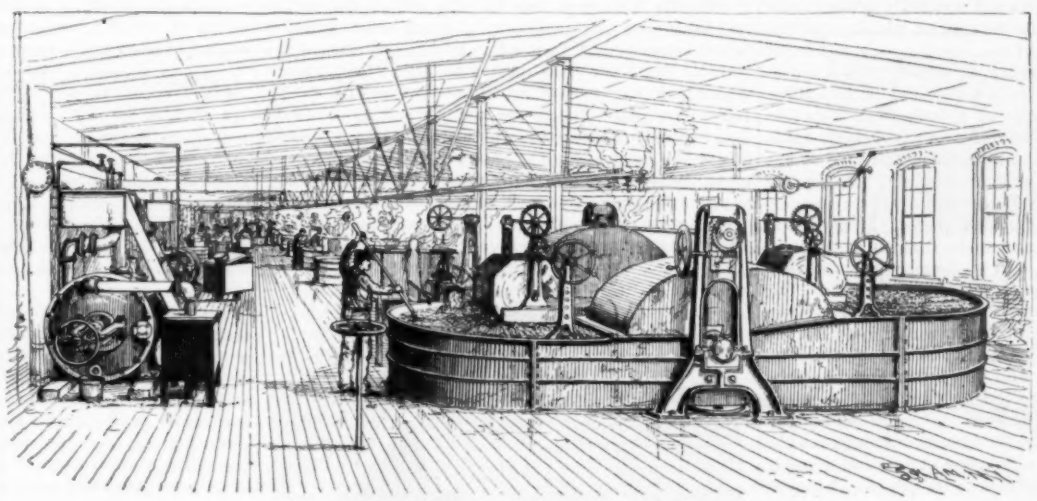
REPRESENTATIVE INDIAN CHIEFS, INDIAN CONGRESS, OMAHA EXPOSITION.

Indians, their chief fear was that it would be necessary to renew the old tribal feuds, but, once on the ground, this idea was soon dispelled, and it is now amusing to see with what formality the tribes exchange civilities. For instance, when the Sioux Indians pay a call to the Arapahoes, the visitors dress with great care and march singing to the Arapahoe village. The Arapahoes met them with a song of welcome, and a formal handshaking follows with an exchange of gifts, and peace is declared between the two tribes. Of course, in most cases the Indians are not able to communicate with each other except through the aid of an interpreter, as their languages are different.

Our engraving shows a group of representative Indians of two of the most interesting tribes, the "Flatheads" and the "Assiniboins." The Assiniboins are considered particularly good Indians, and cause little disturbance. They boast that they never fought white men, but with the Cheyennes, Crows, Black Feet, and Nanktons. "Different Cloud," "Kills the Spotted Horse," and "Four Bulls" are three famous chieftains of the Assiniboin tribe. All three were born at the Fort Peck Agency, Montana, and have lived there all their lives. "Different Cloud," also known by the name of James Garfield, is thirty-two years of age, and in the famous battle waged between Gen. Miles and Sitting Bull, on Milk River, he did good work for the government, his horse being shot under him. In the course of the fight he scalped six of the Sioux and captured twenty-five horses. "Four Bulls" is also known by the name of James Robert. His career has been a comparatively peaceful one, having only been in one fight against the Crows. He is twenty-nine years of age and speaks English. "Kills the Spotted Horse," whose English name is Allen Clancy, is thirty-three years of age. Five years ago he took part in a fight with the Creeks, and his horse was shot under him and he received two wounds which resulted in his being laid up for three months. When he got well he started out with a party of friends to seek revenge. They stole sixty-five horses from the Creeks and returned home to the agency with this booty. They were promptly arrested for fighting and placed in the guardhouse. The spirit of their forefathers evidently dwelt with them, for they agreed to die by each other's hands. By some means they procured a pair of scissors, with which they stabbed each other. When the jailer arrived, all were dead but "Kills the Spotted Horse," who afterward recovered in the hospital. He is about as striking a type of Indian as any at the Exposition. Antoine Moise and Eneas Michel are from the Flathead agency in Montana. Antoine Moise, though only a little over thirty years of age, has had a very eventful career. Eight years ago he was wounded in battle between the Flatheads and Crow Indians, and the Crow Indian who shot him is on the Indian encampment grounds at Omaha. The other event in his life was his trip to Washington in 1893 to see the "Great Father."

Eneas Michel is twenty-four years of age and has lived all his life on the agency. He speaks English very well and does not call for any special mention.

The scene, particularly at night, is intensely picturesque. Small cooking fires scattered around dimly light up the strange picture, throwing a red glow upon the decorated tepees, while across the trails prance the stalwart braves lavishly decked out with blankets. It is a curious and interesting fact that less than half a century ago the same docile Omaha Indians who peacefully doze by the camp fires within the Exposition gates were waging the war of the tomahawk and arrow on these very grounds, which is a gratifying proof of the triumphal march of civilization.



BEATING AND REFINING ENGINES.

THE MANUFACTURE OF PAPER.

III.—THE PAPER MILL.

In our issues of March 19 and April 30, of this year, we described at considerable length and with the aid of numerous illustrations the processes by which the spruce and poplar logs are manufactured into sulphite and soda fibers. It was shown how the logs are cut into "chips," the length of whose fiber is from one-half to three-quarters of an inch; treated with chemical solutions in huge "digesters," where the "cooking" serves to dissolve out the soluble, incrustating matter of the wood—resin, lignose, cellular matter—leaving only the pure fiber; then washed and screened, and finally bleached, leaving a pure, white, vegetable fiber ready for manufacture into paper in the paper mill proper.

Before describing the final processes, it will be well to mention that there are, broadly speaking, at least six different grades of paper recognized by the manufacturers.

1. The lowest and cheapest of these is *wrapping paper*, such as is used for large parcels and packages. This is made from the screenings and refuse from the different mills.

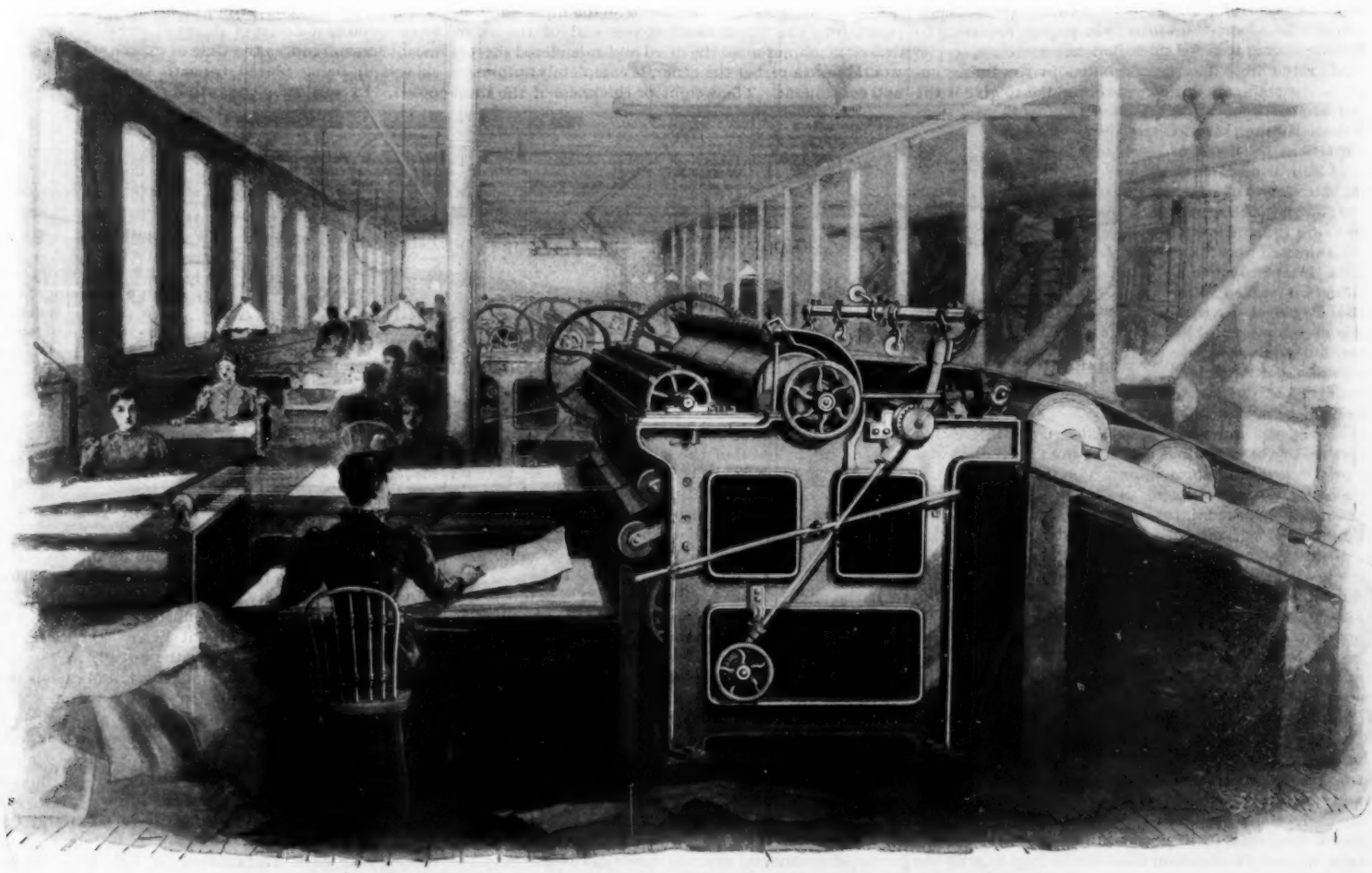
2. *Cheap or "bogus" manila*, made chiefly from ground wood and sulphite fiber, and used for cheap bags, such as are used in retail stores.

3. *Best grade manila*, made from jute and old rope, used for flour sacks and cartridge paper.

4. *News papers and hanging papers*, manufactured from ground wood and sulphite pulp. This grade is practically the same as No. 2, with the difference that the cheap manila is colored. The wood pulp not being chemically treated, the resinous and acid matter remains in the pulp, and in course of time dis colors the paper. It is for this reason that old newspapers become discolored and fade to a yellowish tint.

5. *Book paper*, such as that upon which the SCIENTIFIC AMERICAN is printed, made from bleached sulphite and bleached soda fiber, mixed.

6. *Fine writing papers*, such as note, bond, bank note, tracing, and bank folio paper. This is made from a mixture of rag and wood fibers, and the finest



THE MANUFACTURE OF PAPER—MACHINE FOR CUTTING THE FINISHED PAPER TO SIZE.

grades are manufactured from new cotton and old linen rags.

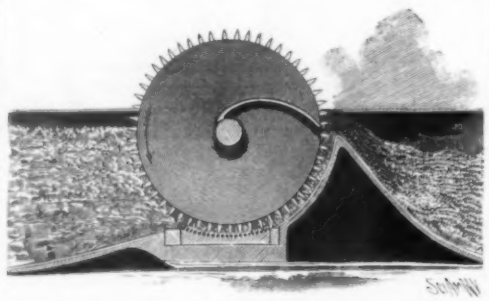
The first step in manufacturing the pulp into paper is to place it in what is known as the beating engine. This consists of a shallow, cast iron tank with semi-circular ends, on one side of which, with its axis at right angles to the longer axis of the tank, is a large revolving roll about four feet in diameter. The surface of the roll is filled with a series of "fly bars," or parallel strips of steel ⅜ inch in thickness and about 5 inches in depth, which extend the full width of the roll and are spaced about 2 inches apart around its periphery. The radius of the roll is slightly greater than the depth of the tank, the bottom of which is curved upward to the rear of the roll, leaving only a narrow passageway for the stream of liquid pulp to pass through. Immediately below the roll a bed-plate, covered with rubbing-strips of ¼-inch iron, is let into the floor of the tank. The roll is carried in adjustable journals, whereby the space between the face of the roll and the bed-plate may be regulated. The beating engine is 3½ feet deep by 24 feet long, and its capacity is over 1,500 pounds of finished paper. It is loaded with bleached sulphite and soda fiber, brought from the respective mills, and with the proper percentages of clay, starch, sizing, alum, and other materials. The rotation of the roll causes the mixture to flow slowly around the tank. The pulp is drawn in between the roll and the bed-plate, where the action of the iron bars serves to separate and draw out and beat the fiber. By raising or lowering the roll and increasing or reducing the space between the opposing bars on the roll and the bed-plate, the fiber is drawn out to the desired extent. The manipulation of this roll is one of the most important operations in the process of paper-making.

On the opposite side of the engine to the roll are two washers, eight-sided revolving cylinders of wire cloth, with interior scoops which run from the wire cloth face to the interior and serve to catch and drain off the water that passes in through the cloth. The object of the washers is to completely remove all chemicals and other soluble impurities that come over from the sulphite and soda mills. Water flows continuously into the tank on one side and is drawn off by the washers on the opposite side. The process of beating and washing is carried on for about one hour; then the various mixtures, as given above, are added and the engine is run for several hours longer until the process is complete.

The pulp is then allowed to fall down into tanks from which it is pumped to the Jordan refining engines, which are shown to the left of the beating engines in the illustration. This machine consists of a swiftly revolving cone upon the surface of which is a series of knife blades. The cone revolves within a conical drum and the pulp is introduced at the smaller end and driven by centrifugal action to the larger end, at which it is discharged. The purpose of these machines is to make the fiber of an even and suitable length, that which is to be made up into thin papers requiring to be longer than that for thick papers.

After the fiber has been treated in the fining engines, a certain amount of water is added to give it the proper consistency, and it is run through screens located at the head of the Fourdrinier paper machines, two of which are shown in the accompanying illustrations of the Duncan Paper Mills. The Fourdrinier machine, so named after the Frenchman to whom this beautiful invention is due, is one of the most ingenious and perfect devices to be found in the whole range of the industrial arts. The most interesting feature of the machine is the endless traveling wire cloth, herewith illustrated, on which the fiber is interlocked or woven as it were, the water drawn away, and the residue worked into sheet form. The pulp, duly beaten, refined, screened, and diluted with water (as explained above), is piped into the "flow box," a deep rectangular box extending across the full width of the machine), from which it flows out in a thin stream onto an endless 70-mesh wire cloth. The cloth is 118 inches wide and runs over end rollers placed 36 feet apart. To prevent the stream of pulp (which has the appearance and consistency of watered milk) from flowing laterally over the edges of the wire, two endless rubber guides or bands, 2 inches square in section, travel with the wire over the first 20 feet of its length. These guides, known as deckles, run over two pulleys above the wire. The upper half of the wire is supported by and runs over a series of rollers as shown in the illustration. As the pulp passes from the flow-box the particles of fiber float in it just as an innumerable multitude of particles of cotton fiber would float in a stream of water. To unite and interlace the fibers, the wire is given a lateral oscillating or shaking movement, which serves to interlock them much as the warp and woof are interlaced in a textile fabric. Meanwhile the water strains through the cloth, leaving a thin layer of moist interlaced fiber spread in a white sheet over the wire. The separation of the water is further assisted by troughs (suction boxes), which extend across close beneath the wire. Suction pumps connected to these boxes draw the water from the pulp as it passes over them.

The wire with its layer of moist pulp now passes below a roll (known as the "dandy roll") which compresses the fiber, and then below a second and larger roll known as the "conch roll," upon which is a felt jacket shrunk tightly on, which presses out more of the water. The fiber next passes to the "first press," where it is caught up on an endless felt and passed between two rollers, the upper one of wood, the lower of iron covered with rubber, where more water is pressed out of the sheet. Then it passes through the "second press," consisting of an upper roller of brass and a lower roller of iron covered with rubber, where more moisture is pressed out, and finally the sheet commences its long journey up and down over a series of 17 hollow



ROLL AND BED-PLATE OF THE BEATING ENGINE.

revolving iron cylinders, 4 feet in diameter, which are heated by steam. A "drier felt" passes over the rolls with the paper, for the purpose of holding it snugly against the hot surfaces. By the time it has passed over the 17 rolls the sheet is thoroughly dried out.

The surface of the dried sheet is at this stage of the process rough and entirely devoid of the gloss which is indispensable in all "book papers" with the exception of "antique," book paper being the particular grade the manufacture of which we are now describing. The desired finish is secured by passing the sheet through what are called "calender rolls"—a vertical stack of 9 highly polished iron rolls, which "iron" the paper as it passes through them and impart the proper degree of gloss or "finish." The sheet enters at the top and leaves at the bottom of the rolls, whence it is wound onto a wooden reel. There are two stacks of calender rolls to each paper machine.

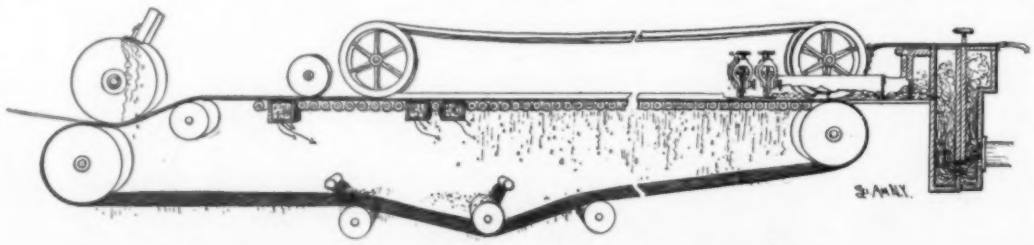
The whole process, from the time the liquid fiber is piped into the "flow box" at one end of the Fourdrinier machines until the dried and calendered sheet is wound onto a reel at the other, is completely automatic and continuous. The weight or thickness of the sheet is determined by the amount of flow of the fiber to the screens. The speed of the paper sheet, when the machine is running on "book paper," such as that on which the SCIENTIFIC AMERICAN is printed, is 140 feet per minute. When the machine is running on "news paper," such as that on which the daily papers are printed, the speed is as high as 500 feet per minute, or nearly 6 miles an hour.

If the paper is to be given a specially high finish, it is run onto wooden rollers and goes to the super-calenders, a series of 9 rolls in which the alternate members consist of chilled refined iron and paper, the paper and iron rolls being of different diameters. The rolls act upon the surface of the paper with a mangling effect, which imparts the desired finish. If a very high finish is desired, the sheet is passed a second or third time through the calenders.

The rolls of paper, which, as they come from the Fourdrinier machine, are from 92 to 112 inches wide, are then carried to the cutting machine (see illustration) and placed in a rack, from which they are drawn over a series of rollers and cut into sheets of the size required for the market. The disk cutters, which are seen arranged on a transverse bar above the first roll, cut the sheet into strips of the desired width, which are then cut to the proper length by a transverse knife.

The paper is then counted, weighed, and either boxed in wooden frames, baled in hydraulic presses, or rolled onto iron or wood cores ready for shipment.

There are few of the arts in which development has been more rapid or the changes more radical and sweeping than in the great industry which has formed the subject of the present series of articles. So true is this, that a first-class mill like that which we have now described, unless it holds itself at all times prepared to make costly changes to keep pace with the improvements of the art, would find itself falling hopelessly behind in less than a decade.



FOURDRINIER MACHINE—DIAGRAM OF THE ENDLESS WIRE CLOTH AND DECKLES ON WHICH THE FIBER IS RUN OUT INTO SHEET FORM.

Fluorescent Screens for Roentgen Ray Work.

A contributor to The British and Colonial Druggist says, from personal experience, that effective fluorescent screens may be made by the amateur, and that a material reduction in cost is thereby effected. Calcium tungstate he regards as a very fair material, and a salt of uranium he thinks very good (the particular salt not being mentioned). The method of making the screen is as follows: Take a plate of glass, say 8½×6½ inches; make a mask of stout paper with an opening 7×5; wet this mask with glycerine or mucilage of gum arabic and place it over the plate; cover the plate with collodion, or varnish, or mucilage (with a little glycerine added), and sift the powdered salt quickly and evenly all over the surface. If vellum, parchment, cardboard, or ebonite be used as the support, one may put a coating on both sides, and thus even up any inequalities of deposit; but with a glass support the same advantage will not accrue. Having got a good thick coating of powder, the mask is removed, but this does not matter very much; it has served its purpose to give a clear edge to the coating. The coated side, which must face the tube, if glass is used, is covered with a piece of thin black celluloid, or ebonite, or opaque paper. With vellum, parchment, or paper there should still be a black shield between the tube and the fluorescent salt, but the latter should be left uncovered and facing the eye. The platinocyanides may be used in the same way, though they do not powder nor sift so finely; or they may be mixed with varnish and spread over a glass or vellum surface; the trouble is to get a really even coating, but, with anything but glass one can apply a roller pressure and thus smooth down any unevenness. The easiest way to get an even coating, according to the author, is to use a vehicle of paraffin and petrolatum. Equal parts of each are melted together, stirred until cool, and the powdered salt (about two drachms for a 7×5 screen) rubbed on a slab with just enough of the wax mixture to make a workable mass, which is spread by means of a long, straight spatula. An undesirable feature is the liability of the mixture to "run" in a heated atmosphere, but at normal temperature no trouble whatever is encountered. The author mentions that in addition to its value as a means of direct observation, the fluorescent screen reduces the time of exposure in making a skiagraph, being placed beneath the plate when exposed. In conclusion the author remarks: "Of course, it must be understood that even the best and most costly screen will not fluoresce to any extent if the rays are being delivered poorly and intermittently; it will not compensate for a poor and weak electrical discharge and faulty tube. As a gage by which to estimate exposures, I consider a good screen very valuable. With practice one becomes as intimate with the capabilities of his 'tubes' as a photographer with the capacity, as regards covering power and rapidity, of his lens."

Telegraphy Without Wires in Belgium.

Consul Gilbert sends from Liege, under date of July 19, a letter from a professor of a San Francisco school of engineering, who has been investigating inventions in wireless telegraphy. The professor refers to the system of Dr. Della Riccia, connected with the Montefiore Institute of Electricity, at Liege. Dr. Riccia has made improvements on apparatus already in use, simplifying it and increasing its power, and claims that he can confine the oscillations of the transmitter to any special point, to the exclusion of all others. In case of communication between war vessels or forts, the message could be transmitted to one alone; in case of fog at sea, the oscillations would not be limited. Dr. Riccia, it is said, can make the presence of a vessel known to another at a distance of 30 miles and telegraph real messages 7 miles. The full text of the report has been transmitted to the War Department.

SPIRIT SLATE WRITING AND KINDRED PHENOMENA.—II.

BY W. E. ROBINSON.

A favorite trick of mediums at séances is to procure a message from the unseen on the blank piece of paper which has been placed between two slates. The medium holds the slates high above his head, and on taking the slates apart the paper is found covered with writing. This again calls for the use of an extra, or false flap, as shown in Fig. 1. (See our last issue.) A piece of paper with writing on it is placed downward on one of the slates and covered with the false flap. Of course, it now looks like an ordinary slate.

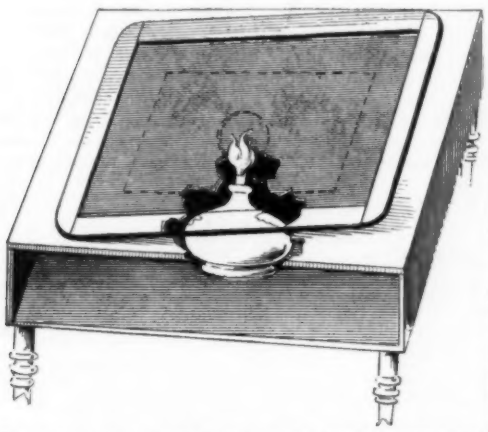


Fig. 4.—FALSE TABLE FOR DEVELOPING COMMUNICATIONS WRITTEN WITH SYMPATHETIC INK.

On this is placed the plain piece of paper, and over it is placed the second slate. The slates are now held up, and, on being lowered to the table, they are reversed, thus bringing the blank piece of paper under the false flap and the one with the writing on it on top of the flap which has fallen from the slate. On the removal of the top slate, the writing is found on what is supposed to be the original blank paper.

If the paper is to be privately marked by those who attend the séances, so as to make sure that the writing really appears on the piece of paper selected, another method must be employed, and the aid of the so-called "sympathetic ink" is invoked. Sympathetic inks are of various kinds, some appearing through the aid of a reagent and others through the agency of heat. The latter method is usually employed by mediums. The writing is done with dilute sulphuric acid, which is made weak enough so that the paper will not be destroyed. The heat required to develop the writing is obtained from a spirit lamp, which is concealed in the top of the table. The lamp is set directly under a trap in the table top. When the slates are placed on the table, they are laid over the trap, which is opened and the slates allowed to become well heated. The trap is then closed, and the prepared paper, upon coming in contact with the hot slate, is covered with writing.

Another method to produce spirit writing is to place a wide mouthed bottle over the trap. A piece of paper is put into the bottle, which is corked and sealed, and the writing makes its appearance after setting the bottle over the small trap in the table so that it receives heat from the alcohol lamp.

Unfortunately for the medium, he does not always have an audience that is willing to take the manifestations on faith. Some of the people who come to the séances insist on bringing their own slates. The medium takes the slates, which are tied and sealed by skeptics, and has no difficulty in obtaining writing upon them. The result is that it furnishes the most positive proof of spirit power to the unbeliever. Let us suppose that the spectator brings a thoroughly clean slate and holds one end of the slate in one hand and the medium the opposite end, and both persons clasp their disengaged hands. In a short time the slate is turned over and a few words are found written in a scrawling hand. The secret of this phenomenon will be readily understood by referring to Fig. 5. A piece of slate pencil is fastened to a thimble and this is attached to the medium's fore-finger of the same hand which holds the slate. The thimble is fastened to an elastic which goes up the sleeve, so that, the instant the writing is concluded, the thimble is pushed off with one of the fingers and disappears up the medium's sleeve. There is always considerable danger of detection to the medium in using this device; so that the method shown in Fig. 6 is adopted by some mediums. A tiny piece of slate pencil, no bigger than a pencil lead, is placed on the tip of the forefinger, and over it is secured a piece of flesh-colored court plaster. The finger is painted with aniline or other colors, so that the line of demarkation between the court plaster and the flesh is eliminated. After the court plaster has set, a small aperture is made in it, so as to allow the point of the pencil to come through far enough to be able to mark on the slate. The writing is done with this prepared finger. The message must be written backward, so that when the slate is reversed it will appear in its correct position. The message must necessarily be short, on account of the limited distance which the medium's finger can travel.

A Course in Railway Mechanical Engineering.

Cornell University has always been in the lead in the introduction of novel and eminently useful courses, and now one more course has been added. It is called the Graduate School of Railway Mechanical Engineering, and, of course, it comes under the Sibley College of Mechanical Engineering, of which Dr. Thurston is the Director. The school was organized in February, 1898. Its purpose is to concentrate and systematize the work in the mechanical engineering of railway machinery previously constituting a subordinate part of the existing courses, and to offer special instructions to students who have completed a general course in technical institutions of high rank, and, furthermore, to members of the engineering profession desiring special knowledge in this field. For all such, in addition to instruction in this department of engineering, immediate practical value courses of work are also available in other departments of the college and of the university. The courses in the school will have special relation to the design, construction, operation, and maintenance, and the test trials of locomotives and other kinds of machinery employed in railway operation. They will be particularly adapted to the needs of the engineer seeking to find his way into the departments of construction of railways, and ultimately into the positions of superintendent of shops and of motive power. In addition to the courses offered in Sibley College as purely professional, there will be found in the scheme of the special courses leading to advanced degrees opportunities of pursuing work in economics, in law, and in allied professional and scientific departments. The school will so arrange its work as to connect closely with the undergraduate work of Sibley College. Students in the undergraduate courses may begin to specialize in their junior year and to increase considerably this specialization in their senior year. The principal of the school is Prof. H. Wade Hibbard. He has been well known in the railroad world since his graduation from Brown University, thirteen years ago.

FATE OF STERNWHEELERS DESIGNED FOR THE YUKON.

Of the forty sternwheel steamers designed for navigation of the Yukon River and which have attempted the ocean passage, only about eight, or one in five, have been successful. The larger number of these vessels have sailed from Seattle and kept to the inside route, along the coast. Several attempts have been made also from Portland and San Francisco, but with the most disastrous results. The experience almost invariably has been that frail, light draught steamers of this character cannot withstand the great ocean swells, and, in a vast majority of cases, collapse. Fortunately the loss of life in these catastrophes has not been great, as they are always accompanied by an ocean steamer, upon which the passengers in time of danger have been transferred, or else the boats have been so near port as to enable them to return before being completely disabled. There are now about sixty sternwheelers navigating the Yukon, most of which have been constructed in the lower ports, their timbers then being taken apart and carried to St. Michael's and there set up.

The last attempt to sail sternwheelers by the ocean route was made at Astoria, Oregon, some weeks ago, when two, in every respect equal in size and power, started for Alaska, filled with passengers and weighed down with freight. They had been built in Portland and were advertised as being staunch and seaworthy. They were about 125 feet in length and were rated at 300 tons. They were fitted with all the conveniences for travel, electricity, hot water, etc., and each one had over a hundred passengers. They were named the "Game Cock" and "Stag Hound," and cost altogether $125,000. They were accompanied by the steam collier "Elihu Thomson" and left port with every prospect of a fine voyage. It was only a few hours afterward these same steamers returned in the condition shown in the photograph. The great swells off the Columbia River bar had proved fatal. At the first essay both boats were wrecked and were only prevented from sinking by the fact that before starting every particle of space had been utilized for storing wood for the boilers. By great good fortune the two succeeded in reaching port, where they were photographed for the SCIENTIFIC AMERICAN.

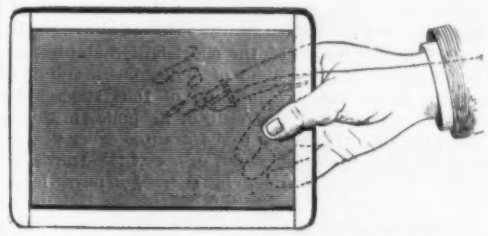
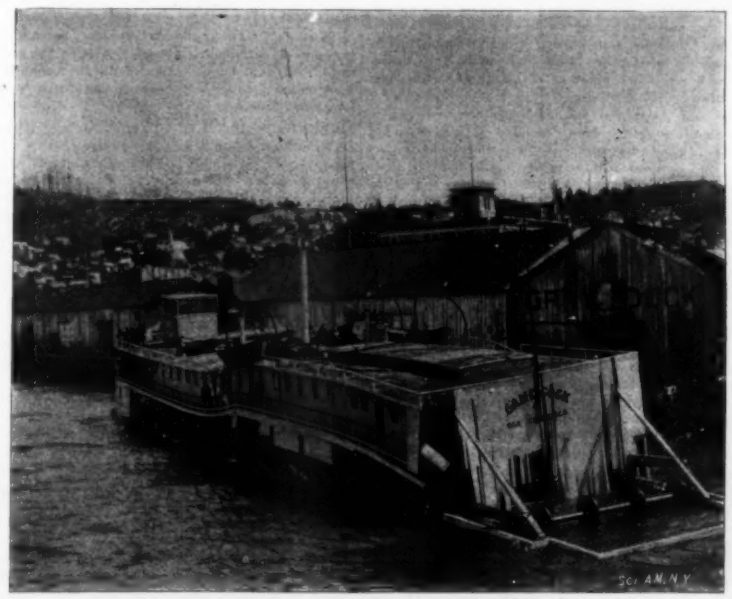


Fig. 5.—WRITING ON THE SLATE WITH THE PENCIL THIMBLE.

Fig. 6.—THE PREPARED FINGER.



STERNWHEEL RIVER STEAMER WRECKED BY GROUND SWELL IN ATTEMPTING OCEAN PASSAGE TO ALASKA.

A Brave Deed.

Few readers are aware that our warships carry boiler makers who are often called upon to perform perilous repairs, and, in cases of emergency, these men go inside of the boiler or furnace, which but a few minutes before had been filled with boiling water or red hot coal. There is no task too dangerous for these men to do. One of them undoubtedly saved the "Castine" from destruction in the harbor of San Juan. The "Castine" went into action under full speed. The furnaces were heated to the highest degree, forced draught being used. Without warning, a fierce hissing noise was heard inside one of the furnaces. A socket bolt in a back connection at the farthest interior extremity of the furnace had become loose, springing a leak. The steam was pouring in upon the fire, threatening in a few minutes to put it out and stop the progress of the vessel, if it did not cause a terrific explosion. All in the boiler room knew that, unless this hole was stopped, disaster was at hand. One of the boiler makers, named Huntley, ordered the forced draught turned off and the fires banked. Taking a plank, he threw it into the furnace on the top of the wet, black coal with which the fire had been banked and then climbed far back to the place where the steam was rushing from the loosened socket. For three minutes he remained inside the furnace. His friends drew him out of the door; the forced draught was turned on, and in a few minutes the ship was proceeding on her way as though nothing had happened. In view of such deeds as this, there is little wonder that the engineering corps in our navy is receiving the highest praise on every side.

THE faintest stars visible to the naked eye are of the sixth magnitude; the faintest telescopic stars are reckoned of the sixteenth or seventeenth magnitude.

Italian Railways.

The Italian engineer Giuseppe Spera makes in his book, which has lately appeared, some interesting revelations with regard to the Italian railways, and his remarks are worthy of general attention, says The Engineer. Italy possesses a railway system of the value of 140 milliards of lire and 9,334 miles in length, and thereby occupies the eighth place among the countries of the world; but, when one compares the length of the railway system with the number of the inhabitants, Italy is reduced to the forty-first position on this list.

The management of nearly all the Italian lines is in the hands of three companies since 1885, when the state leased the three systems of the Mediterranean, the Adriatic, and the Sicilian railways to the above companies. But, by reason of the shortsighted and bureaucratic nature of the system of management laid down by the state, the development of the railways has been hampered, and as a result of its policy in this respect the sum of £240 has to be granted every year by the state for every kilometer, or about two-thirds of a mile. The time occupied in short journeys leaves much to be desired, and in this matter the Italian railways are in evil plight; this is all the more remarkable since 70 per cent of the passengers make only short distance journeys.

The express trains convey only first and second class passengers, and the passenger trains can at most attain but a speed of from 20 to 23 miles an hour. The passenger rates are certainly not higher than those in use in other countries, but they are much too high in comparison with those current in England, for the population of Italy has scarcely one-fourth of the income enjoyed by the population of England per head. The goods traffic is in an equally bad state; viewed as a whole, the forwarding of goods by rail in Italy is becoming worse and worse, and is far behind the system of conveyance by carriers.

Although the unsatisfactory state of the railways from a commercial point of view may in some degree be traced to the unstable condition of Italian politics, yet the technical shortcomings of the whole system and the unreasonableness displayed in its administration must not be lost sight of; thus, there are from seven to nine officials for every 1,100 yards of railway, while in North America three officials are found to be quite sufficient for the same extent of line. In comparison with other countries, Italy has the largest railway staff. Moreover, the uncertainty and want of security in the goods traffic leave very much to be desired. It is said that matters have come to such a state on the Italian railways that the authorities have resolved to introduce very thorough and drastic reforms.

Travelers have for many years suffered at the hands of the Italian customs officials at the frontier stations, and it is certainly surprising that Italy has been so long in realizing that more attention ought to be paid to the wants of the traveling public, so far as the Italian railways are concerned; year by year new routes are being opened up for the tourist, and the conditions of travel upon such routes are of a nature that for the most part leads one to avoid the discomfort that, as a rule, falls to the lot of the tourist in Italy.

The Current Supplement.

The current SUPPLEMENT, No. 1189, contains a large number of interesting articles and engravings. The first page cut shows the destruction of a balloon 2,000 feet high by means of the new French 7·5-cm. field-piece, and the effect on intrenched infantry of shrapnel fire. "The Chimes of Saint-Germain-l'Auxerrois" describes the most modern form of mechanical bell ringer. "The Electrical Suspension Railroad" is accompanied by a full-page engraving showing the railroad between Elberfeld and Barmen as it will appear when finished. This is an extraordinary development of the elevated railroad, in which the cars are suspended from inverted Y's. "Kangaroo Hunting in Queensland" is illustrated by a spirited engraving showing the hunters in full chase after these animals. "Color Vision," by F. P. Whitman; "The Development of Photography in Astronomy," by Prof. E. E. Barnard, and the "Inaugural Address of Sir William Crookes," are concluded or continued in this number. "Musical Susceptibility of Animals" is an interesting article by Nicolas Pike. Among the technical articles are: "The Dangers of Acetylene," "Black Printing Processes," "Spinning, Stamping, and Working of Aluminum and Brass Sheet," and "Culture and Preparation of Orris Root." "The Neo-Occultism" describes a striking experiment with the X-rays. The column of "Selected Formulæ" is given up in this issue to formulas for the destruction of animal parasites.

Contents.

(Illustrated articles are marked with an asterisk.)

Azores, rats in the 244
Battleship, our latest 242
Bed, extension* 245
Bicycle lock* 245
Bicycles, light weight 242
Bullets, wooden, Spanish 243
Coins, nickel and aluminum 246
Cross lighting 245
Cyclone in New York State, a* 244
Deed, a brave 251
Fishes, slime on 245
Fluorescent screens for Roentgen ray work 250
Gondola: its history and manufacture 247
Indian congress and the Omaha Exposition* 248
Inventions, recently patented 252
Notes and receipts, miscellaneous 246
Omaha Exposition.* 248
Paper, the manufacture of.—The paper mill, III* 241, 249
Railway engineering, a course in 251
Railways, Italian 252
Sailor, uniform of the 243
Santiago, improvements in 246
Science notes 246
Spirit slate writing and kindred phenomena, II.* 251
Song birds, importing, for our woods 242
Sternwheelers, wreck of* 251
Supplement, the current 252
Telegraphy without wires in Belgium 250
Telephone kite, the 244
Water, purifying* 245
Wimshurst machines, collectors for 247

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

LAWN-MOWER.—HARRY JACKSON, Kingston, N. Y. The purpose of this invention is to provide a lawn-mower in which the knives are so shaped as to obtain the best cutting action, and in which the cut grass will free itself from the machine, thus preventing clogging. In a frame a shaft is mounted carrying blades formed of plain metallic plates. The plates are held diagnally with reference to the shaft, the blade having a tapering flange at its outer edge. This flange is at an angle to the blade and projects beyond one side, running gradually from zero at one extremity to the greatest width of the flange at the opposite extremity. A ledger-knife is held to be engaged by the edge of the knife-flange.

Bicycle Improvements.

UNICYCLE.—VERNON D. VENABLE, Farmville, Va. The unicycle forming the subject of this invention is provided with a rim or spokeless wheel composed of two parts, one sliding upon the other. A seat-support is pivoted upon the inner part of the rim to swing in the plane thereof. A drive-wheel is carried by the inner rim, engages the outer rim and has a limited movement relative to the inner rim. To the inner rim a saddle-post is pivoted and a frame secured. A drive-wheel is adjustably mounted in the frame and has recesses to receive projections on the outer rim. A pedal-shaft is carried by an upright and operates a driving connection between the pedal-shaft and the shaft on which the driving-wheel is mounted.

Electrical Appliances.

ELECTRIC RAILWAY SYSTEM.—GEORGE L. CAMPBELL, Dushore, Pa. This invention is an improvement in electric railway systems, and comprises means by which a closed conduit may be operated. A surface-rail made in short, insulated sections is used, and a trolley or follower within the conduit communicates with a continuous conductor and the third rail or sectional conductor. The car is made to travel by the influence of a magnet mounted on the car. The third rail is normally "dead." The system is hence exceedingly safe, and needs no protection in the way of fences. The workmen employed need take no special care to avoid the rail.

Engineering Improvements.

ROTARY-ENGINE.—JAMES C. WALKER, Waco, Tex. The rotary-engine of this inventor is an improvement on an engine already patented by him. The present engine comprises a fixed annular chamber, a sliding abutment, a drive-shaft having a concentric piston, shaft-operated means for lifting the abutment and a steam-chest for the chamber having a duplex set of steam-ports, one set being at each side of the abutment. A hand-operated sliding valve opens and closes the inlet of one set and the exhaust of the other set of ports. The chest has independently and automatically operated supplemental valves, movable over the inlets and ports. Fixed cams are carried by the shaft to move the supplemental valves in one direction, centrifugal adjustable cut-offs moving them in the reverse direction. Either of the supplemental valves may be set out of engagement with the shaft. Cam and cut-off devices hold this valve to close off its respective steam inlets.

ICE STEAMBOAT.—ANTOINE I. SHERMAN, Punta Gorda, Fla. In this steamboat, improvements in construction are found which enable the boat to be readily handled and navigated on ice or snow, the driving mechanism being operated by steam-power. The boat comprises a frame having adjustable runners thereunder mounted upon vertical pivots, a steering-wheel connected with certain runners whereby they may be used as rudders, and propelling mechanism carried upon the frame and consisting of a rotating wheel having teeth engaging the ice.

Mechanical Devices.

LOCK.—ALFRED L. GARLOUGH, St. Paul, Minn. The lock forming the subject of this invention is of especial value in tenements, offices, and the like, where it is usually necessary, when key-locks are used, to fit new keys for every new tenant. With this lock it is only necessary to change the combination, and thus the expense of new keys is avoided. The lock comprises a casing in which a locking bolt and a latch-bolt are movable. A series of tumbler-carriers are mounted to swing in the casing, and have openings at one side in line with a projection of the locking bolt. Tumblers are adjustable across the openings. The tumbler-carriers may be lifted one independently of the other, the locking and latch-bolts being moved inwardly after the carriers have been lifted. The combinations of the lock may be changed by removing the several carriers.

ALARM MAIL-BOX.—CYRUS R. FUREY, Logansport, Ind. The mail-box provided by this invention is adapted for private use and is an improvement in such boxes as have an alarm attachment, designed to be operated when the lid is opened. The present box has a body with a sounding box in which a gong is located. A wheel is arranged facing and close to the gong, and is provided with a series of curved teeth. A spring has its free end arranged for contact with the teeth, and is provided with a clapper adapted to strike the gong. A rod connects the hinged box-lid with that side of the wheel toward which its teeth are curved, to operate the device on opening the lid.

APPARATUS FOR MANUFACTURING WOOD-ALCOHOL.—MARTIN F. QUINN, Straight, Pa. The main object of this invention is to devise an arrangement so that provision is made for the expansion and contraction of the retort in its housing, without injuring the surrounding brick-work. With this end in view, the inventor places the retort in a housing which has a pier midway of its length and on which the central portion of the retort rests. Two or more other piers are placed on each side of the first-named pier, and on these the retort loosely rests. By this means the retort will contract toward each end from the middle. The discharge-pipes leading the products of distillation from the retort to the condenser are passed through openings in the side of the housing of larger diameter than the pipes. Hence the side walls of the housing, as well as the ends and top, have no connection with the retort, and the housing is not injured by the expansion and contraction of the retort.

TIRE-BOLTING MACHINE.—JOSEPH R. WHITAKER, Wilmington, O. This machine comprises a slotted beam provided at one end with means for securing it to a support and carrying an adjustable hub-pin held in place by a clamping device. A slide is held adjustable on the outer end of the beam and has a post also formed with a bearing, in which a frame is movable that carries a casing at its inner end. Meshing gear-wheels are held in the casing, one of which is provided with a central tapered opening in which a nut-jaw is removably fitted and adapted to engage the nut of a tire-bolt. A shaft is connected with the other gear-wheel and a lever is fulcrumed on the post of the adjustable slide and carries a tool adapted to engage the slot in the head of the bolt.

WOOD-TURNING LATHE.—NELSON R. SPRINGER, Dixfield, Me. The lathe forming the subject of this invention is provided with a movable carriage with which a lever is connected. A toothed bar is adapted to be engaged by the lever to move the carriage forward a predetermined distance. A cutter-head controlled by means of the lever moves in the carriage and is adapted to face off the end of the stick. On the carriage a cutter is fixed for turning the end of the stick round before facing it. The machine is especially adapted to the turning of checkers.

MERRY-GO-ROUND.—WILLIAM HERFURTH, New York city. This merry-go-round comprises principally a revoluble frame having its axis inclined from a vertical plane, and a flexible platform supported freely from the frame to permit the sections thereof to assume a horizontal position by gravity. When the frame revolves then the hobby-horses or other devices always stand in a horizontal position, so that, when the machine is in motion, the hobby-horses incline toward the platform. Thus the rider, carried by one of the hobby-horses, is always in a level position, with a changing floor or platform, so that a spectator gains the impression that the hobby-horse with its rider is moving or rocking.

FRUIT-JUICE EXTRACTOR.—GEORGE N. GUTHRIE, Gallatin, Tenn. The apparatus patented by this inventor is adapted to extract the juice of fruit and comprises a casing, a perforated cylinder having cutters for reducing the fruit to pomace and mounted to rotate in the casing, a screw-shaft extended through the cylinder, and a presser-plate in the cylinder adapted to be moved by the screw-shaft. This machine may be made of any size and will be found useful for household purposes when it is desired to make a small amount of fresh cider and the like.

Miscellaneous Inventions.

METHOD OF AND MEANS FOR DELIVERING PNEUMATICALLY-CONVEYED GRAIN.—FREDERIC E. DUCKHAM, London, England. In conveying grain pneumatically, the grain flows in a somewhat attenuated stream suspended in a current of air of such high pressure that the air and grain travel at a great velocity. The result is that it is well-nigh impossible to deposit the grain in any particular spot if it is projected from the discharge pipe at a high velocity. In the present inventon, this objection is overcome by changing the direction of the grain just before it emerges, whereby its high velocity is destroyed. Before the air current can overcome the inertia of the grain and again impart to it its initial high velocity, the air will have become dispersed in the surrounding atmosphere, while the grain, freed from the propulsive action of the air, masses in a thick stream and flows out slowly, so that it may be deposited wherever desired.

DERAILING-DEVICE.—DAVID ANDERSON and DAVID BEVAN, Delphos, O. This device consists of a base adapted to be fastened to a railroad tie, to which base a flange is pivotally connected, having its free end formed with a trough arranged to fit down over the head of the rail. The flange is formed with a diagonal groove commencing at one end at the inside of the trough and below the upper wall thereof and extending over the trough to its outside. An abutment follows the line of the groove on the inside thereof, the upper edge of the abutment being considerably above the upper surface of the free end of the flange above the trough.

SACK-HOLDER.—MONTY A. LYON, Wisdom, Mont. The device provided by this inventor comprises a standard having a central support and side members between which the support is located, and a holder consisting of a band adapted to engage a sack or the like at the mouth and engaging the side members of the standard, the holder being provided with a hook adapted to engage the support. The hook can be readily disengaged whenever desired, to permit the sack to be shaken, after which operation the hook can be again conveniently attached to the support and the filling completed.

WRENCH.—CHARLES S. METCALFE, Silver City, New Mexico. To provide a wrench which will grip either round or polygonal bodies with equal firmness is the purpose of this invention. The shank of the wrench is provided with a fixed jaw and carries an adjustable traveler. A movable jaw is fitted upon the shank and pivotally mounted at its heel upon the traveler. A lever is interposed between the front of the movable jaw and the traveler and fulcrumed on the latter, the lever having a cam-surface in engagement with the movable jaw at the front thereof.

DISCHARGE-VALVE FOR ASH-PITS.—JOSEPH SEDLMAYER, New York city. This invention is an improvement upon a device of a similar nature for which a patent was granted to the same inventor. The chute is provided with hinged wings. A sliding hinge-bolt is also provided, having above its axis a sleeve with a wedge-shaped end adapted to engage the upper surface of the wings to lower or open them. Another sleeve is secured to the bolt below its axis and is provided with a wedge-shaped end adapted to engage the lower surface of the wings to raise or close them.

COIN-CHUTE.—CHARLES J. TAYLOR, Shelbyville, Ill. The chute devised by this inventor is designed more especially to be used in connection with telephone pay-stations. In one side of the casing of the chute are fixed stops one above the other and insulated from one another. A vertically-moving plate is located at the opposite side of the casing and is provided with two stops, one above the other. The two lower stops are in an electric circuit designed to be closed by a coin engaging with the lower stops. The telephone-lever has connection with the movable plate. The movable stops are so related to the fixed stops that when the telephone lever is held downward the two upper stops will retain the coin; when the lever is raised, the coin will be released from the upper stops and caught and held by the two lower stops until the lever is moved downwardly, releasing the coin from the lower stops.

DISH-DRAINER.—HENRY M. TSCHOPP, Pickerington, O. This dish-drying tray has a leg to support its outer portion and has a fastening device or jaw capable of engaging the edge of a pan, whereby to support the inner portion of the tray and permit the dishes to drain into the pan and to dry upon the tray.

TIRE-HOLDER.—JOHN D. AITKEN, Northport, N. Y. The purpose of this invention is to provide a device to support a tire above a blacksmith's anvil so as to carry most of the weight thereof and permit ready manipulation. The support comprises a tube with a series of lateral pin-receiving holes, a bar slidable within the tube and having a side-extending hook upon its lower end, a spring attached to the upper end of the bar, and a pin adapted to pass through the holes in the tube and engage the upper end of the spring.

ACETYLENE GAS-GENERATOR.—GEORGE L. HOGAN, Baltimore, Md. This acetylene gas generator belongs to that type in which an external tank, holding water, is combined with an inverted bell or buoyant gasometer dipping down into the water at its lower edge and containing a basket for the calcium carbid. The gasometer, on being raised out of the water by the pressure of the gas, carries the carbid out of contact with the water and thus stops further generation until the gas already generated has been consumed. The present invention adapts this form of generator for use as a street-lamp and for other large lamps.

TOBACCO PIPE.—THOMAS MCE. GILL, Mexico, Mo. This invention seeks to do away with the varnish and filling or other polished finish commonly used on cob and wood pipes, which varnish often destroys the desirable qualities of a pipe. To secure a fine external finish and shape which will permit the thorough cleaning and ready renewal of the bowl or lining of the pipe, which will at the same time form an air-chamber surrounding the lining to prevent the exterior of the pipe from being overheated and which will permit the convenient adjustment of the casing to take up shrinkage from time to time as may be desired, the pipe forming the subject of the present invention has been devised. The inventor also secures such results by a special construction of casing which serves to form an ornamental exterior and which strengthens the material.

Designs.

COMBINATION GARMENT.—JACOB H. FLEISCH, New York city. This garment is a combination coat and waistcoat, and constitutes a desirable sporting costume. To the flaps of a coat waistcoat flaps are secured, which, when buttoned, present the appearance of a waistcoat beneath a coat.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

WIRELESS TELEGRAPHY POPULARLY EXPLAINED. By Richard Kerr. With preface by W. H. Preece. New York: Imported by Charles Scribner's Sons. 1898. Pp. 111. Price 75 cents.

In the last two years considerable interest has been manifested in wireless telegraphy, and, so far as we know, this is the first book upon the subject. The experiments of James B. Lindsay, Mr. Preece, Marconi, and Dr. Lodge are given concisely, but the book is confessedly intended for popular use.

HANDBUCH DER BAUSTOFFLEHRE. Bearbeitet von Richard Krüger. Two volumes with 443 illustrations. Vienna: A. Hartleben. Large octavo. Pp. 887. Price, paper $8.

Within the last fifteen years artificial building materials have become so numerous and have found so wide an application that a book in which they are discussed in detail should be welcomed. In the work now lying before us, the author, besides describing the natural materials used in building, such as stone, wood, and the like, also treats of those important artificial substances now so generally employed. In describing the various building stones and woods, the author has made use of his own experience and of the tests made by the German government at its various experiment stations. The book is divided into three sections. In the first section, the natural and artificial stones, the earths and metals are discussed. The second section treats of the various mortars, asphaltum, and cement. The third section deals with the making and use of glass, resin, tar, paints, varnishes, caoutchouc, guttapercha, oiled cloths, asbestos fabrics, carpets, ropes, hemp, and moss. In order to facilitate the use of his work, the author has compiled an exhaustive index of the subjects discussed. The book will be a desirable acquisition to the libraries of architects, engineers, and manufacturers of building materials.

BUILDING CONSTRUCTION AND SUPERINTENDENCE. By F. E. Kidder. Part II. Carpenter's Work. New York: William T. Comstock. 1898. Pp. 544. 524 illustrations. 8vo, cloth. Price $4.

Mr. Kidder has long been known to the manufacturing profession through his "Architect's and Builder's Pocket-book," and in the present volume he deals with the materials employed by the carpenter and joiner, more especially with the details of all forms of wooden construction, from the rough framing of wooden buildings to nicely finished cabinet wood. The work is in every sense what may be called a practical one, while at the same time the reasons for, and advantages of better systems of construction are intelligently pointed out, and also the defects of cheaper and more common forms. The book will not only be of value to the carpenter, but will be simply invaluable to the architect. With the aid of clear sections of windows, doors, etc., the architect will not have to spend much time thinking out the proper arrangement of stops, stiles, etc. He will only have to refer to this book to find a large scale section which will give him just the information he wants with the dimensions lettered upon it. Hardware of all kinds is described, and the proper method of applying it is shown. It is one of the most valuable books which ever appeared on the subject in this country and we have no hesitation in recommending it.

THE AMERICAN STREET RAILWAY DIRECTORY AND BUYERS' MANUAL. New York and Chicago: E. L. Powers. 1898. Published quarterly. Price $3 per annum.

This directory contains a complete list of electric, cable, horse and elevated railways in the United States, with the capital, bonds, names of the officials, mileage, gage of the track, number of cars, power plant, names of the makers of the generators, engines and boilers, etc. It also contains some valuable statistics of the worth, mileage, capitalization, and car equipment of street railways in the United States, from which we find that there are at present 909 electric roads out of the 1,074 roads which exist in the United States. In other words, there are at present over eight times as many electric roads as horse roads, and only twenty-one cable roads are now in operation in the entire country. The capital stock of these 1,074 roads amounts to $975,625,827, and the bonds amounts to $1,527,979,220, the total mileage 16,466·78, and there are 48,209 cars in use.

POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES FOR 1898. Thirty-first Annual Number. New York: H. V. & H. W. Poor. 1898. 8vo. Pp. 1,600. 70 maps. Price $7.50.

Poor's Manual is always a welcome visitor. It is simply invaluable to all who are engaged in any part of the railroad world. All who are in any way interested in securities will find the book indispensable. Each railroad is taken up in turn. The mileage of all main lines, branch, and leased roads are then given, and in the case of leased lines the annual charge is given. Then comes the history of the road, a detailed account of its rolling stock, floating equipment, operations for the year, capital stock, bonds, equipment trusts, etc. Then comes full information regarding leased roads. From this it will be seen that the book contains information of such a wide range that it is simply invaluable to all who are interested in any way in railroads. The total mileage of railroads of the United States at the end of 1897 was 179,692·57 miles. The total length of track was 236,911·52 miles. There were also 35,810 locomotive engines, 25,275 passenger cars, 8,133 mail cars, etc., and 1,229,335 freight cars. Total liabilities of the various roads amounted to $11,631,711,740. The number of passengers carried was 504,106,535, and 788,385,448 tons of freight were moved. There are a number of pages with just such statistics which are of importance from an economic point of view. In addition to steam roads, street railways, and miscellaneous corporations, there is also a department of State and municipal indebtedness. The book is well printed and contains a perfect mine of information.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Gasoline Brazing Forge, Turner Brass Works, Chicago.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Schwaab Stamp & Seal Co., Milwaukee. Send for cat'g.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., Spring and Varick Sts., N. Y.

FERRACUTE Machine Co., Bridgeton, N. J. Full line of Presses, Dies and other Sheet Metal Machinery.

Easy Experim'ts of Organic Chemistry. Book by Prof. Appleton. 60 cents. Snow & Farnham, Providence, R. I.

For Sale—File of SCI. AM. from June, 1895, to date. Cheap. "Machinist," 77 Jefferson Av., Jersey City, N. J.

Hub, spoke, wheel, bending, and handle machinery. Single machines or full equipments, by the Defiance Machine Works, Defiance, Ohio, U. S. A.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

"Model Engineer and Amateur Electrician," a first-class paper, published every month. Annual subscription, 75c. Send 8c. for sample number. Agents wanted. Spon & Chamberlain, 12 Cortlandt St., New York, U. S. A.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7509) X. asks: If a pendulum were hung on a frictionless pivot and placed in a perfect vacuum, would it continue to swing forever, if once set in motion? A. We do not know the answer to this question. There never was a pendulum hung on a frictionless pivot, nor was there ever a perfect vacuum produced, and even if both these conditions were met, there has not been a forever in which to see if the pendulum might not, somehow, after all, stop. All the light which can be thrown on this problem comes from Newton's first law regarding inertia, which is to be found in every text book of physics. We should prefer to devote our time and space to real questions.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

OCTOBER 4, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abdominal bandage, A. S. Markle 611,920
Acid, method of and apparatus for making durable fluids containing carbonic, H. Gronwald 611,732
Aerated waters or beverages, apparatus for making, Emringer & Marchand 611,616
Alarm lock, E. N. Case 611,992
Almond huller, J. E. Beach 611,765
Animal catcher, W. E. Tidler 611,744
Animal exterminator, C. K. Myers 612,000
Animal trap, J. B. Davis 611,749
Asphalt from crude petroleum and petroleum tar, obtaining, Forward & Davidson 611,630
Assaying apparatus, Adams & Younger 611,966
Awning, F. C. Tabler 611,872
Awnings, etc., fastening device for, W. F. Maulick 611,737
Back pedaling brake, J. W. Hoffman 611,963
Back pedaling brake, J. B. A. Juhel 611,966
Ballast unloader, H. H. Warner 611,877
Bars, means for straightening and cooling, R. W. Lundy 611,696
Barrel head making machine, J. H. Reed 611,939
Barrel or keg stopper, J. Hulme 611,910
Bath and wash tub, combination, S. W. Hendrickson 611,630
Beams, means for securing furring strips to metallic, L. L. Sagendorph 611,796
Bearing for shafts, thrust, G. E. Wright 611,984
Bearing, side, P. H. Murphy 611,925
Bearings, ball retaining device for ball, E. Klahn 611,689
Bed, tent, boat, etc., combined, H. C. Brown 611,636
Beehive, C. Winter 611,746
Bell ringing mechanism, H. S. Ross 611,794
Bicycle, O. Fetzer 611,780
Bicycle, P. J. Parker 611,865
Bicycle chain and sprocket guard, J. W. Fulford 611,750
Bicycle driving mechanism, H. H. Fefel 611,779
Bicycle handle bar, F. W. H. Weishaupt 611,668
Bicycle holder, Brown & Williams 611,856
Bicycle lock, C. H. Melquiond 611,757
Bicycle luggage carrier, N. O. Harman 611,905
Bicycle stand, T. Beecher 611,672
Bicycle support, I. H. Sapp 611,798
Bicycle tubes, tool for joining, E. Taylor 611,802
Bicycle wheel guard cleaner, H. S. Miller 611,699
Bicycle wheel hub, P. L. Hussey 611,787
Boiler flue cleaner, N. B. Hamilton 611,904
Boiler furnace, steam, O. D. Orvis 611,975
Boiler furnace, steam, R. W. Tucker 611,961
Boiler tube ferrule, G. W. Duvall 611,959
Bolt lock, M. E. Robertson 611,941
Book, manifolding pass, Beck & Ruffhead 611,600
Book rest or desk, rotatable, F. Knoedler 611,946
Bottle holder, nursing, A. C. Buck 611,635
Bottle, non-refillable, W. H. Caldwell 611,831
Bottle, non-refillable, C. O. Swickard 611,718
Box. See Journal box. Mail box. Stuffing box.
Box fastening device, A. J. Lauer 611,637
Brazing or soldering metals, Midgley & Fink 611,922
Broiling and toasting device, E. M. Alderson 611,595
Brush, shaving, L. Legrand 611,969
Brush, tooth, I. N. Lincoln 611,788
Bucket, hoisting, T. M. Jenkins 611,911
Bulkhead doors, apparatus for automatically closing, W. & A. R. Crawford 611,833
Burglar alarm, S. Comfield 611,772
Burial casket, Whitcomb & Barton 611,980
Burner. See Gas burner. Prairie burner.
Burner, C. G. Smith 611,949
Button, H. Wirth 611,881
Button making machine, J. Hormby 611,811
Button punch press, W. E. Bennett 611,988
Button punching machine, W. E. Bennett 611,989
Cap forming mechanism, Hoffman & Frist 611,632
Car coupling, J. Swihart 611,656
Car fender, Collyer & Bullock 611,677
Car mover, P. Wise 611,747
Car trip mechanism, J. R. White 611,852
Carbureter, H. T. Bradley 611,674
Carriage, baby, J. L. Pryor 611,937
Carrier. See Bicycle luggage carrier.
Cart, folding, H. F. L. Brookmeyer 611,675
Cartridge holding attachment for belts, R. C. Langdon 611,692
Case. See Velocipede gear case.
Ceiling or wall plate, metallic, L. L. Sagendorph 611,797, 611,798
Chains, locking device for connecting bolts of drive, W. C. Soule 611,950
Chair. See Collapsible chair.
Chair, M. I. Wisler 611,882
Cigar package, C. F. Zenker 611,671
Clamp. See Colter clamp. Rubber dam clamp.
Cleaner. See Boiler flue cleaner. Dish cleaner. Rail groove cleaner.
Clevis, plow, E. W. Kruse 611,690
Clock, alarm, F. Gundorph 611,733
Cloth cutting machine, N. Komow 611,861
Cloth folding machines, feeding mechanism for, G. A. Schulze 611,799
Cloth sponging and shrinking machine, G. Rothholz 611,795
Clothes drying apparatus, T. Jackson 611,688
Clothes pounder, A. J. & J. B. Ziegler 611,727
Clothes wringer driving mechanism, J. W. Banks 611,827
Cock, safety gas, R. Schelble 611,762
Coin tester for coin controlled apparatus, J. H. Volkmann 611,825
Collapsible chair, Ruckdeschel & Mockel 611,942
Colter clamp, H. I. Stone 611,955
Confection dipping tray, L. J. Anger 611,987
Cooking or heating utensil, L. Brainard 611,955
Coop for poultry, etc., folding, C. Hoskins 611,753
Corn sheller, ear clipping attachment for, J. Donovan 611,807
Coupling. See Car coupling. Hose coupling. Thill or pole coupling. Thill or tongue coupling.
Crate, collapsible, J. Cunningham 611,836
Crates, registering device for poultry, N. B. & D. Updike 611,720
Culinary vessel, A. W. Obermann 611,705
Cultivator, G. W. Noble 611,644
Cultivator, hand, G. L. Roby 611,649, 611,651
Currents, apparatus for adjusting phases of alternating, J. H. F. Gorges 611,902
Cutter. See Metal cutter.
Dish cleaner, M. D. Colbath 611,607
Door spring, J. M. Gillihan 611,997
Drawing board, R. W. Lundy 611,697
Drawings, transferring, G. Itasse 611,687
Dredging drag, J. Edwards 611,634
Drill. See Grain drill.
Drilling tool, W. H. Skinner 611,947
Dye and making same, blue, M. Ulrich 611,664
Dye and making same, orange, M. Ulrich 611,663
Dye and making same, violet, H. Hasenczamp 611,628
Dye, brown cotton, R. Demuth 611,630
Dye, green blue tetrazo, J. Bammann 611,597
Dye, indigo blue cotton, R. Demuth 611,611
Dyeing hair or fur, T. C. Stearns 611,870
Egg beater, E. Wishart 611,736
Egg poacher, G. W. Knapp 611,843
Electric meter, S. Evershed 611,809
Electric time switch, F. M. Schmidt et al 611,822
Electrical circuit controller, N. Tesla 611,719
Electrical connector, J. Fedriani 611,707
Electrical wireman's combined gage and calculator, H. Luts 611,971
Electromagnetic engine, P. B. Watson 611,850
Electrometer, E. Weston 611,724
Elevator gate, automatic, A. Turner 611,682
Elevators or lifts, hoisting mechanism for, Lundell & Rennerfelt 611,693
End gate fastening device, C. M. Davis 611,678
Engine. See Electromagnetic engine. Rotary engine. Thermal expansion engine. Traction engine.
Engine, F. G. Ball 611,853
Engine, F. W. Ofeldt 611,792
Engine tender, traction, W. S. Kelley 611,635
Engines, fire extinguisher and blower for traction, J. G. Baxter 611,598
Excavator, N. C. Wright 611,986
Fastenings, machine for inserting metallic, L. A. Casgrain 611,990
Feed water filter for steam boilers, H. B. & J. S. Watson 611,667
Feeder and carrier, cane, Webre & Haydel 611,878
Feeder, steam boiler, J. A. Sumner 611,871
Feeding apparatus, boiler, J. R. Kelley 611,907
Fence, G. P. Smith 611,981
Fence fastening device, wire, H. H. Hemann 611,783
Fence machine, W. F. Seargeant 611,800
Fence machine, slat and wire, W. F. Seargeant 611,944
Fence stay and fastener, N. B. Leslie 611,639
Fence stay and lock, wire, H. Kees 611,913
Fence, stay wire, C. E. Robinson 611,648
Fence stretcher, wire, J. M. Trull 611,690
Fence, wire, J. Truax 611,659
Fencing, wire, R. H. Bloomer 611,673
Fender. See Car fender.
File for letters, bills, etc., W. H. Stewart, Jr 611,716
Filtration, system of, Langdon & Brown 611,691
Firearm locks, safety attachment for, O. Rose 611,977
Firearms, cylinder stop for revolving, D. B. & J. H. Wesson 611,826
Fire escape, Britt & Enns 611,988
Fire escape, F. Hafelfinger 611,734
Fires in domestic fire grates, appliance for kindling or reviving, J. M. Hollinshead 611,964
Flooring of strengthened concrete, system of, F. Hennebique 611,908
Fluid pressure regulator, J. H. Champ 611,892
Fruit or vegetable sorting machine, A. O. Dillman 611,859
Fruit, preparation of, W. Forsyth 611,782
Funnel, S. A. Hess 611,962
Furnace. See Boiler furnace.
Furniture joint, A. Peterson 611,933
Gage. See Pressure gage.
Gaging implement, J. E. Goddard 611,625
Game apparatus, G. E. Murphy 611,758
Game apparatus, H. T. Pycroft 611,868
Game, combined bowling, G. Brown 611,828
Game, ring, J. Klauder 611,915
Garden implement, J. Miller 611,641
Garment supporter guard, J. M. Anck 611,593
Gas burner, incandescent, O. Kern 611,914
Gas burner, multiple incandescent, E. Lindner 611,756
Gas generator, acetylene, W. J. Baulieu 611,985
Gas generators, regulating cock for acetylene, N. H. Medberry 611,698
Gas meter, J. Greenall 611,626
Gate. See Elevator gate. Tilting gate.
Gate, R. Pratt, Jr 611,936
Gate, Sayre & Johnson 611,740
Gate fastener, wire fence, A. Schlapbach 611,741
Gear cutting machine, N. A. Wheeler 611,851
Gelatin thread or filament, insoluble, A. Millar 611,814
Generator. See Gas generator.
Glass blowing machine, L. H. Dolan 611,613
Glass vessels, apparatus for finishing necks of, E. Hoffman 611,631
Gold from ores, process of and apparatus for extracting, B. C. Hinman 611,998
Governing device, A. Fischer 611,619
Governor, steam engine, G. H. Firth 611,729
Grain binder deck, S. K. Dennis 611,776
Grain binder knotter, S. K. Dennis 611,775
Grain drill, Jones & Carr 611,942
Grain dropper spout, D. A. Smith 611,980
Grinding and pulverizing machine, J. Pottgens 611,867
Grinding machine, A. R. Clarbe 611,893
Grinding machine, G. G. Crowley 611,834, 611,835
Grinding machine, automatic ball, D. E. Kempster 611,968
Grinding machine, ball, Hunt & Haddow 611,842
Grindstone, D. Shannon 611,946
Handle. See Jar handle.
Hanger. See Coat hanger.
Harvesting and husking machine, corn, D. McMannama 611,791
Hat, G. Wildman 611,985
Hat and coat hanger, O. Wigtil 611,669
Hat bag, M. L. Horning 611,633
Hats, coats, etc., support for, W. W. Vail 611,721
Hats, fur trimming for ladies', J. F. Vorck 611,875
Hinge, E. Schmidt 611,742
Hinges, machine for manufacturing sheet metal, Smith & Mortson 611,714
Hoist, power, J. Des Brisay 611,777
Horse checking device, runaway, J. McKenzie 611,702
Horse detaching device, H. Michael 611,736
Horse retainer, H. A. Stevens 611,654
Horseshoe, M. C. Gray 611,731
Horseshoe, soft tread, M. C. Gray 611,730
Horseshoe with removable calks, N. Svenson 611,717

(Continued on page 254)

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Star Foot power Lathes ★ Screw... ...cutting Automatic Cross feed

9 and 11-inch Swing.
New and Original Features
Send for Catalogue B.
Seneca Falls Mfg. Company,
695 Water St., Seneca Falls, N.Y.

POWER & FOOT LATHES | SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. SCROLL SAWS. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

Pipefitters!
Your kit is not complete unless it includes the famous
STILLSON WRENCH
which is particularly adapted for turning out the best work *without crushing the pipe* in the least. All parts are drop-forged. Once tried, it is always used. It has many imitations but no equals. See explanatory cuts. Price list on application to
WALWORTH MFG. CO., 20 Oliver Street, Boston, Mass.

LATHES
FOR GUNSMITHS, TOOL MAKERS, EXPERIMENTAL AND REPAIR WORK, ETC.
Send for Illus. Catalog.
W. F. & Jno. Barnes Co.
1999 Ruby Street,
ROCKFORD, ILL.

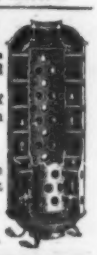
The Coburn Patent Trolley Track
Store Ladders.
A PAIR OF STAIRS ALL ALONG THE LINE OF SHELVES.
☞ *Send for Book.*
The Coburn Trolley Track Mfg. Co.
HOLYOKE, MASS.

THE FORBES PATENT DIE STOCKS.
Two and three inch pipe can be threaded by a boy using only one hand on a crank.
☞ *Send for illustrated catalogue*
CURTIS & CURTIS,
No. 30 Hand Machine. Range ¼ to 2" R. & L.
6 Garden St., Bridgeport, Conn.

WOODWORKING MACHINERY.
For Planing Mills, Carpenters, Builders, Furniture, Chair, Vehicle, Wheel and Spoke Makers, etc.
☞ *Correspondence Solicited.*
Illustrated 312-page Catalogue free to manufacturers and foremen.
THE ECAN CO.
327 to 347 West Front Street,
CINCINNATI, OHIO.

Physical and School Apparatus
THE THERMOPHONE
A new instrument for
Measuring Temperatures
Will take temperature of anything at any range or distance.
☞ *Circular free.*
E. S. RITCHIE & SONS,
BROOKLINE, MASS.

SAVE ½ YOUR FUEL
By using our (stove pipe) RADIATOR
With its 120 Cross Tubes,
ONE stove or furnace does the work of TWO. Drop postal for proofs from prominent men.
TO INTRODUCE OUR RADIATOR,
where we have no active agent we will sell at wholesale price. Write at once.
ROCHESTER RADIATOR COMPANY,
89 Furnace St., ROCHESTER, N. Y.



For Heavy Continuous Work

every machine shop will commend our **Power Pipe Threading and Cutting Machine.** Cones are central over machine, equalizing the weight. Within the cones are compound gears giving six changes of speed. Gears require no extra space, and are protected from dust or accidents. Chasers can be opened, threaded pipe removed, another inserted and cut without stopping machine. ☞ *Send for Catalogue.*
THE MERRELL MFG. CO.
501 Curtiss Street, TOLEDO, OHIO.

Queen's Patent "Triple Plate" Toepler-Holtz Electrical Machine.

Can be used at all times of year and in all kinds of weather. Prices range from $25 to $50. ☞ *Circular on application. We carry a complete line of Electrical and Physical Instruments and Apparatus.*
QUEEN & CO., Inc.
1011 Chestnut St.
Philadelphia, Pa.

EDUCATION BY MAIL

Thousands have been helped to better pay & positions through our system of instruction

Buildings erected expressly for this purpose at a cost of $225,000

Courses of Steam, Electrical, Mechanical or Civil Engineering; Chemistry; Mining; Mechanical and Architectural Drawing; Surveying; Plumbing; Architecture; Metal Pattern Drafting; Prospecting; Bookkeeping; Shorthand; English Branches.

$2 A MONTH pays for a College Education at Home. 45,000 Students and Graduates.

Circular FREE. State subject you wish to study.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 942, Scranton, Pa.

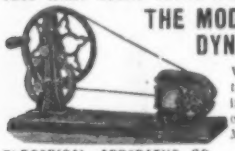
Learn the Watch Trade

JEWELRY and ENGRAVING.

Address PARSONS' INSTITUTE, Horological Dept.,
Bradley Polytechnic Institute, PEORIA, ILL.

THE HARRINGTON & KING PERFORATING CO.
LARGEST MANUFACTURERS IN THE WORLD OF
PERFORATED METALS
STATION "F" CHICAGO, U.S.A.

JUST WHAT EVERY YOUNG ELECTRICIAN WANTS!



THE MODEL DYNAMO-MOTOR.

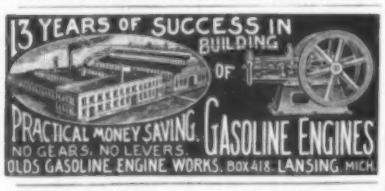
Will Decompose Water, Do Electro Plating, Light Incandescent Lamps, Run Machinery, etc.

ELECTRICAL APPARATUS CO., - ELBRIDGE, N. Y.

PLUMBERS' LEVEL.

An adjustable incline Level, a fixed Level, and a Plumb. Shows incline by 32ds, or less, to 2 in. to the foot. A longitudinal groove in seat of frame adapts it to rest on pipe or shaft. Price 15 in., with plain glass, $3.00; with ground glass, $6.00.

Catalogue of Fine Tools free. THE L. S. STARRETT CO., Box 13, Athol, Mass., U. S. A.


13 YEARS OF SUCCESS IN BUILDING OF
PRACTICAL MONEY SAVING
GASOLINE ENGINES
NO GEARS. NO LEVERS.
OLDS GASOLINE ENGINE WORKS. BOX 418. LANSING. MICH.

Wanted by Purchase

or otherwise, SOLE CONTROL of mechanical commercial Patents for Europe. Must be absolutely genuine. Advertiser ready to manufacture. Full particulars to H. STEVENSON, Box 773, New York.

Frontier Gas and Gasoline Engines

The Frontier Tandem. Two cylinders. The Frontier Vertical. *Send for catalog.* FRONTIER IRON WORKS, 6 Chene St., Detroit, Mich. YARYAN CO., Eastern Agents, 142 Times Bldg., N. Y.

This beats Wind, Steam or Horse Power. We offer the WEBSTER 3½ actual horse power

GAS ENGINE

for $150, less 10% discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100 therefore we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline. Also Horizontal Engines, 4 to 30 horse power.

☞ *Write for Special Catalogue.*

WEBSTER MFG. CO., 1074 West 15th St., CHICAGO
Eastern Branch, 35-D Dey Street, New York City.

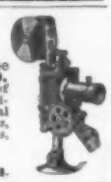
NO FIRE, SMOKE, OR HEAT. ABSOLUTELY SAFE

$200 and up. Send 5 stamps for Catalogue.

Truscott Boat Mfg. Co., Drawer 9, St. Joseph, Mich.

GAS AND GASOLINE ENGINES
WATER MOTORS
BACKUS WATER MOTOR CO. NEWARK N.J. U.S.A.

The Latest Moving Picture Machine



for Calcium or Electric Light, or can be attached to any lantern. Only $35.00. Weight only 5 lbs. Lantern Slides of Cuba, the Philippines, Hawaii, Porto Rico, Army Camp Views, Illus. National Songs. *Send for bargain list of Machines, Films, Slides, Stereopticons and Supplies, Graphophones and Records.*

WILLIAMS, BROWN & EARLE,
920 Chestnut St., Philadelphia, Pa.

THE BERKEFELD FILTER

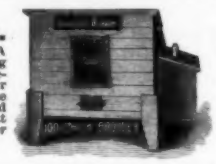
The Standard of the World. The only filter removing typhoid and cholera bacilli from the water. Tested and recommended by Bacteriologists all over the world. The greatest invention in the filter technic during the last ten years. The filter gives water in small and large quantities according to the sizes. Easily cleaned, filter cylinders sterilized by boiling in water. Send for circulars to

BERKEFELD FILTER CO., - 4 Cedar Street, New York.

Hose coupling, B. F. Farrow	611,618
Hose reel, G. Bossow	611,767
Incubator, A. H. Burr	611,728
Jack. See Lifting jack.	
Jar handle, C. E. Pierce	611,708
Jar or bottle fastener, J. L. & E. A. De Steiger	611,958
Joint. See Furniture joint. Railway rail joint.	
Joists, girders, and the like, construction of, F. Hennebique	611,805
Journal box, C. B. Moulton	611,642
Key. See Telegraph key.	
Key fastener, J. R. Parker	611,646
Knitting machine, I. W. Lamb	611,802
Knitting machine attachment, J. Palmer	611,645
Knitting machine attachment, Taylor & Flad	611,951
Knitting machine, circular, L. Gearhart	611,751
Ladder, extension, C. Napier	611,643
Lamp, F. Billingham	611,806
Lamp, electric arc, S. Bergmann	611,601
Lamp suspending device, arc, J. Borka	611,766
Lantern, G. Eastman	611,808
Lantern safety device, F. H. Dewey	611,858
Leather offal, machine for preparing and reducing, G. Brigalant	611,566
Leather working machine, G. W. Baker	611,883
Leg, artificial, A. Larsson	611,812
Lifting jack, W. H. Newbill	611,705
Lock. See Alarm lock. Bicycle lock. Bolt lock. Nut lock. Padlock. Seal lock.	
Lock, E. D. Miltner	611,730
Lock, J. H. Shaw	611,979
Lubricating device, eccentric, F. O. Ball...611,854,	611,855
Lubricator. See Sight feed lubricator.	
Lubricator, E. McCoy	611,750
Mail bag holder, J. Swihart	611,801
Mail box, F. D. Grapengeter	611,683
Mail distributing device, J. Ungaro	611,803
Manger guard, W. S. Huston	611,999
Manhole head and cover, E. Maher	611,640
Manure scattering machine, P. Ehmke	611,900
Mattress, bed, and seat, folding, Richardson & Young	611,647
Measure indicator, liquid, B. Lenzen	611,755
Measuring instrument, electrical, E. Weston	611,722
Measuring instruments, index needle or hand for electrical, E. Weston	611,723
Meat tenderer, Milne & Mott	611,789
Metal bars, machine for straightening and cooling, R. W. Lundy	611,694
Metal cutter and roller, Beaty & Mazzei	611,509
Meter. See Electric meter. Gas meter.	
Metering system, multiple rate, F. T. McIntyre	611,937
Moistener and sealer, envelope, R. F. Pletcher	611,954
Moistener and sealer, envelope, H. A. Thexton	611,873
Moistener for gummed surfaces, G. S. Hill	611,784
Motion, device for converting reciprocatory into rotary, A. B. Perine	611,932
Motion, means for transmitting, J. H. & E. A. Holmgreen	611,786
Motor. See Pneumatic motor. Sewing machine motor. Water motor.	
Mowing machines, bar lifting mechanism for, C. S. Sharp	611,978
Mowing machines, finger bar for, R. M. Clark	611,965
Musical instrument, V. Maggio	612,005
Nest, hen's, M. S. Barnes	611,884
Net, trawl, J. W. Pearson	611,931
Nipple forming machine, A. I. Jacobs	611,634
Nut lock, B. J. Gillies	611,838
Nut lock, C. Miller	611,915
Nut lock, M. B. Parker	611,930
Nut lock, N. Ratchford	611,976
Nut lock, B. B. Smith	611,847
Ore tailings, process of and apparatus for treating, J. Poole	611,935
Overlay and making it, S. E. Dittman	611,681
Oven, domestic, S. A. Hazlewood	611,684
Oven door, Chadwick & Clarke	611,770
Padlock, permutation, G. W. Stanley	611,982
Pan. See Roasting pan.	
Paper hanging machine, P. R. Cross	611,895
Paper pulp screen, E. W. Goodrick	611,901
Pea or bean separator, M. S. Hill	611,785
Pedal, T. Curley	611,773
Photometer, A. Gartley	611,623
Pigeon trap, E. D. Fulford	611,622
Pile, F. Hennebique	611,909
Pipes, treating metal, R. & J. W. Garland	611,900
Pitman connections, automatic key adjustment for, J. T. Norris	611,704
Planter and fertiliser distributer, combined seed, J. A. Autry	611,805
Planter, corn, C. J. Spurck	611,655
Platform and elevator, S. K. Dennis	611,774
Pneumatic motor, F. W. Hedgeland	611,629
Pole tip, carriage, F. A. Glassford	611,839
Prairie burner and extinguisher, J. Sindelar	611,712
Preserving meats, etc., Lacroix & de Caudemberg	611,918
Press. See Button punch press. Printing press. Soap press. Stamping or punching press.	
Pressure gage, T. Thomson	611,657
Printing press, R. Miehle	611,923
Protector. See Trunk protector.	
Propelling mechanism, W. P. Dickinson	611,679
Pulleys, speed varying mechanism for, G. Smethurst	611,948
Pumps, chamber for, C. Steier	611,823
Race track for dogs, M. Walsh	611,876
Rack. See Trousers rack.	
Rail groove cleaner, girder, L. F. Meyer	611,921
Railway conduit and trolley, electric, J. H. Robertson	611,821
Railway, electric, J. B. Entz	611,778
Railway operating mechanism, street, C. W. Roberts	611,819
Railway rail joint, O. E. Selby	611,945
Railway rail, reversible, C. M. Dissosway	611,690
Railway signal device, electric, L. T. Dube	611,897
Railway signaling, J. G. Schreuder	611,943
Railway switch, W. Preston	611,944
Railway system, surface contact, W. B. Potter	611,760
Reel. See Hose reel.	
Reflector, P. C. Larsen	611,863
Refrigerating and delivery apparatus, milk, D. C. Standiford	611,653
Refrigerator door fastening, B. A. Stevens	611,743
Regulator. See Fluid pressure regulator.	
Roadbed construction, J. H. Robertson	611,820
Roasting pan, self-basting, S. W. Akins	611,954
Rolling machine, tube, F. Deming	611,939
Rolling machinery, metal, W. J. Bradley	611,600
Rolling mill railway carriage wheels, apparatus for, Roberts & Davis	611,793
Roofing, metallic, L. A. Hawley	611,906
Rotary engine, J. W. Miner	611,709
Roundabout and elevator, combined, H. Engel	611,682
Rubber dam clamp, J. Wittkowski	611,670
Sash fastener, D. Gardner	611,961
Saw guard, circular, E. Williams	611,725
Saw set and jointer, J. F. Skersick	611,713
School seat and desk, adjustable, B. Clark	611,606
Screen. See Paper pulp screen. Window screen.	
Screw, jack, T. Coughlan	611,532
Seal, E. J. Brooks	611,889
Seal lock, A. T. Sansbury	611,846
Seat. See School seat.	
Seat cover, outdoor, W. English	611,617
Seeding machine, G. L. Roby	611,650
Separator. See Pea or bean separator.	
Sewing machine, J. A. Brautigam	611,708
Sewing machine, J. B. Dobyne	611,896
Sewing machine motor, Naab & Grant	611,928
Shades, etc., hanger for, Berger & Herrmann	611,886
Shaft device, Sexton, A. G. & E. W. A. Smith	611,606
Sharpener, knife, W. A. Hill	611,686
Sheet metal cutting machine, D. A. Ritchie	611,845
Ships' plates, apparatus for cleaning, W. J. F. Sherman	611,936
Shoe attachment, R. M. Hayward	611,880
Shoe nailing machines, shoe holding jack for, L. A. Casgrain	611,691
Shoe, ventilated, G. Bruck	611,830
Shoes, machine for setting or securing buttons to, G. J. Fanner	611,837
Sight feed lubricator, C. C. Wakefield	611,666
Signal apparatus, H. G. Leopold	611,638
Signaling, J. P. Coleman	611,894
Skirt gores, instrument for laying out, E. P. Follett	611,995
Slotting machine, automatic, A. C. Campbell	611,694
Soap press, R. Savory	611,710
Spinning mule, self-acting, W. Monk	611,816
Spring. See Door spring. Watchcase spring.	
Stamp for crushing ores, etc., D. Embleton	611,615
Stamp, hand, E. L. Murray	611,939
Stamping or punching press, W. R. Jenkins	612,001
Stand. See Bicycle stand.	
Stand, W. G. Koelle	611,754
Station indicator and advertising device, G. W. Reynolds et al	611,940
Steam boiler, water tube, H. Workman	611,952
Stone, composition for artificial, C. Fremchel	611,631
Stool, piano, W. T. Brown	611,891
Stopper. See Barrel or keg stopper.	
Stove, W. J. Keep	612,004
Stove, combination cooking and heating, M. Quinn	611,809
Stove, heating, E. G. Germer	611,624
Stove, laundry, S. Palmer	611,818
Straightening machine, R. W. Lundy	611,695
Straining wheel for liquids, C. S. Wheelwright	611,879
Stuffing box, self-adjusting, C. S. Keeler	612,003
Switch. See Electric time switch. Railway switch.	

(Continued on page 256)

THE UNIVERSAL HATCHER AND BROODER.



Thoroughly Constructed, Attractive in Appearance. A Scientific and Practical Hatcher. Only Self-regulating Hot Water Machine in the market. There is Positively Nothing to Get Out of Order. The Boiler, Radiator and the Part Containing Water are made from the Best Grade of Copper. It is complete and guaranteed to work as represented. Awards and First Premium at New York State Fair, 1898. ☞ *Send Six Cents for Illustrated Descriptive Catalogue to*

E. W. ANDREWS CO., Lock Box 3, ELMIRA, N. Y.

7,000 Guns in Stock

WE SELL GUNS of every reputable American and foreign make, and give wholesale prices to everybody. We carry in stock

Fishing Tackle and Sporting Goods

amounting to a quarter of a million dollars. We can please the fancy of millionaires, or meet the demands of the poorest sportsman and angler. Write for prices, or ask us to send you our Sporting Goods Catalogue. We load and sell over

1,000,000 Hand Loaded Shells a Year

Ask us to send you our price card of hand and machine loaded shells. We have

The largest Gun Repair Shop in America

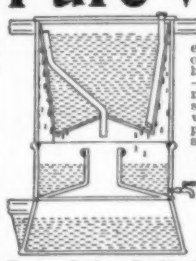
We make guns, re-bore, re-stock, repair—in fact, alter a gun to suit the owner, and guarantee satisfaction. Write for prices.

MONTGOMERY WARD & CO.

Originators of the Catalogue Business — 111 to 120 Michigan Ave. cor. Madison St., Chicago

MENTION THIS PUBLICATION WHEN WRITING

Pure Water



We know if the American public ever really awakens to the real importance of distilled water, we will have to enlarge our factory—though we are the largest manufacturers of water stills exclusively in the world. The only absolutely pure water, aerated with sterilized air, is made by

The Sanitary Still

Pure copper, lined with block tin, and indestructible. It fits any stove, and is as easily managed as a tea-kettle.

Twelve Styles—Double Capacity—Same Price Only Still Recognized by U. S. Government

Write for booklets containing letters from prominent bankers, physicians and pastors from every State in the Union and several foreign countries.

THE CUPRIGRAPH CO., 138 N. Green St., Chicago

CABINET OPEN.

Prices $6.00, $7.50, $12.50

OTHER MAKES

Don't be Deceived by cheap affairs that pull over the head made of three yards of cloth with a hoop at top and bottom.

The ROBINSON CABINET will be sent with privilege of examination. With face steamer if desired.

We guarantee it.

Good salary and commission to good agents. Our interesting books, "*Health and Beauty*," and "*Power of Heat*," sent free.

ROBINSON THERMAL BATH CO.
717 Jefferson St., TOLEDO, O.

Robinson Improved Folding Bath Cabinet

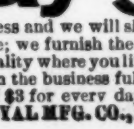
is recommended by the best physicians for rheumatism, neuralgia la grippe, colds, liver, skin, obesity, kidney troubles. Gives beautiful complexion, soothes the nerves, prevents sickness.

This is the only practical cabinet made. It is a perfect cabinet; made of best rubber drill; folds into six inches space like a screen: has a door and is ready for use instantly. Can be heated before entering and top curtains opened to allow gradual cooling.

NOT OURS.

$5 Printing Press

Prints your own cards, labels, etc. Larger press for circulars or small newspaper, $18. Everything easy by printed rules sent. *Catalogue for stamp.* KELSEY & COMPANY, Factory 4, MERIDEN, CONNECTICUT.



OVER A MILLION

chickens hatched in our incubators last season. Our 148-page illustrated catalogue contains description and prices of the most perfect egg Hatchers and Brooders made. Mailed on receipt of 6c. in stamps. Better send for it at once.

DES MOINES INCUBATOR CO., Box 75, Des Moines, Ia.

New "Cold" Process of Galvanizing.

In use for more than two years with best and absolutely satisfactory results. Articles that cannot be galvanized by any other process, such as screws, nuts, cutting instruments, tools of every description, springs, locks, artistic metal articles, can be galvanized in a superior manner by this process. The multitude of articles that can be galvanized is without limit. Uniformly smooth surface is preserved, thickness of coating can be regulated, saving of spelter about 80%, besides many other advantages. *We grant licenses for territory, also shop rights on royalty basis.*

☞ *AGENTS WANTED.* U. S. Electro Galvanizing Co., 348 Broadway, New York.

ROCK DRILLS
AIR COMPRESSORS
SIMPLEST, MOST EFFICIENT and DURABLE.
RAND DRILL CO.
Send for Catalogue 100 Broadway, New York.

"NEW STANDARD" BATTERIES.

Adopted as "Standard" by U. S. Gov't. Imitated but not equaled. Manufactured specially for Medical Apparatus, Dental Surgery, Gas Engine Lighting, Gasoline Launches Telephones, House Bells, Burglar Alarms and ALL OPEN CIRCUIT WORK.

No. 2 sent anywhere at $2 a dozen. Money back if not satisfactory. WM. ROCHE, Manufacturer, 259½ Greenwich St., New York.

For 21 Years we have been building the
CALDWELL CYPRESS TANKS
For every purpose. Most durable known.
☞ *Handsome Catalogue free.*
W. E. CALDWELL CO.,
327 East Main Street, LOUISVILLE, KY.

THE OBER LATHES

Patented.

For Turning Axe, Adze, Pick, Sledge, Hatchet, Hammer, Auger, File, Knife and Chisel Handles, Whiffletrees, Yokes, Spokes, Porch Spindles, Stair Balusters, Table and Chair Legs and other irregular work.

☞ *Send for Circular A.*

The Ober Lathe Co., Chagrin Falls, O., U. S. A.

If you want the best CHUCKS, buy Westcott's

Little Giant Double Grip Drill Chucks, Little Giant Drill Chucks Improved, Oneida Drill Chucks, Cutting-off Chucks, Scroll Combination Lathe Chucks, Geared Combination Lathe Chucks, Plain Universal Lathe Chucks, Independent Lathe Chucks. Made by Westcott Chuck Co., Oneida, N. Y., U. S. A.

Ask for catalogue in English, French, Spanish or German.

FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

NORWALK PATTERN AND MFG CO.
DESIGNERS & MAKERS OF WOOD & METAL PATTERNS
SOUTH NORWALK CONN.

1898 EDITION
—OF—
Experimental Science

By GEO. M. HOPKINS.

20th Edition Revised and Enlarged.

914 Pages, 820 Illustrations.

Price $4.00 in cloth; $5.00 in half morocco, postpaid

THIS is a book full of interest and value for Teachers, Students, and others who desire to impart or obtain a practical knowledge of Physics. This splendid work gives young and old something worthy of thought. It has influenced thousands of men in the choice of a career. It will give anyone, young or old, information that will enable him to comprehend the great improvements of the day. It furnishes suggestions for hours of instructive recreation.

Send for large Illustrated Circular and complete Table of Contents.

MUNN & CO., PUBLISHERS,
Office of the SCIENTIFIC AMERICAN,
361 BROADWAY, NEW YORK.

$3 a Day Sure

Send us your address and we will show you how to make $3 a day absolutely sure; we furnish the work and teach you free; you work in the locality where you live. Send us your address and we will explain the business fully; remember we guarantee a clear profit of $3 for every day's work; absolutely sure; write at once. ROYAL MFG. CO., Box 418, Detroit, Mich.

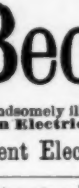
Can I Become an Electrical Engineer?

For our Free, handsomely illustrated book entitled "Can I Become an Electrical Engineer?" address **The Electrical Engineer Institute of Correspondence Instruction, Dept. A,**

Endorsed by Every Prominent Electrical Engineer. (Conducted under the auspices of "The Electrical Engineer"). **120-122 LIBERTY STREET, NEW YORK, U. S. A.**

Electrotypes and Engravings for advertisers made to order; also for inventors from patent drawings. Our patents, "IDEAL" for metal backs, and "TWIN BASES" for movable tops, have no equal for profitable service. Write, for information wanted, to WM. T. BARNUM & CO., Electrotypers and Printers, NAW HAVEN, CONN.

Buy Telephones



THAT ARE GOOD--NOT "CHEAP THINGS."
The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits. Our guarantee and instruments are **both good.**
WESTERN TELEPHONE CONSTRUCTION CO.
250-254 South Clinton St., Chicago.
Largest Manufacturers of Telephones exclusively in the United States.

CALCIUM CARBIDE
Export trade and Eastern States supplied.
E. Aug. Nereshcimer, 35 Nassau St., New York

"American-Hunnings" TELEPHONES.
Transmitters, Magneto Bells and Telephone Switchboards. Over **200,000** of our telephones in successful operation. Used by War and Navy Departments. In ordering state length of line, whether single line or metallic circuit and number of telephones to be used on one line. ☞ *Send for catalogue "S. A."*
AMERICAN ELECTRIC TELEPHONE CO.,
173 South Canal St., Chicago, Ill.

FOR SALE—Patent No. 603,602. Patent Cowl, adopted by all the leading Architects and Builders in Great Britain and other European Countries. Thousands in use. Easily and cheaply manufactured. Every day sale. Address EMIL BRESLAUER, Box 773, New York.

MAGNETO BELLS
ALL KINDS PRICES OF PARTS **TELEPHONES**
ELECTRICAL SUPPLIES
SEND STAMP FOR CATALOGUE. MIANUS ELECTRIC CO. MIANUS, CONN.

ELECTRO MOTOR, SIMPLE, HOW TO make.—By G. M. Hopkins. Description of a small electric motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.

Flat Metallic Belt Lacing
OUTSIDE PULLEY SIDE
ECONOMICAL, EASY, EFFICIENT. CIRCULARS AND SAMPLES FREE.
THE MALIN & CO., Cleveland, O.

SAVES OIL! SAVES MONEY!
Lackawanna Cylinder Lubricator Preserves Steam Pipes and Joints. Adopted by the largest plants in the country. **Saves its cost in oil** over any other device. Write for Catal. Lackawanna Lubricating Co., 1216 Capouse Av., Scranton, Pa.

SO SIMPLE A CHILD CAN USE THEM.
SUNART CAMERAS
28 STYLES, PRICES FROM $5.00 TO $50.00
SEND 2 ct STAMP FOR ILLUSTRATED CATALOGUE
SUNART PHOTO CO. 5 AQUEDUCT ST ROCHESTER N.Y.

AMERICAN PATENTS.—AN INTEResting and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1002. Price 10 cents. To be had at this office and from all newsdealers.

N. Y. CAMERA EXCHANGE.

50% Saved on all makes of Cameras
Headquarters for Buying, Selling and Exchanging Cameras or Lenses. Large assortment always on hand.
Developing, Printing, etc.
Photo supplies of every description at *lowest prices.*
☞ *Send 2c. stamp for bargain list.* Address
N. Y. CAMERA EXCHANGE, 43 Fulton St., NEW YORK

The Yankee DRILL GRINDER
for grinding both Twist and Flat Drills. Grinds all sized drills from ⅛ to 2½ in. Can be set for any size in a few seconds. Gives any desired clearance. Fully guaranteed.
"Can't Grind Wrong." *Catalog free.*
G. T. EAMES COMPANY,
250 Asylum Ave., Kalamazoo, Mich.

KENNEY FLUSHOMETER.

A new device which dispenses with overhead tanks in bathrooms and lavatories. **Economical, Healthy and Durable.** Sanitary Engineers, Builders and Plumbers should examine and satisfy themselves. Exhibition open now. ☞ *Catalogue Free.*
THE KENNEY CO., 72-74 Trinity Place, NEW YORK.

CLUTCH PULLEYS.
ROAD MOTOR ENGINES, WHEELS & TIRES
EXPERIMENTAL AUTO-CAR WORK.
SINCLAIR-SCOTT CO. BALTIMORE, MD.

Switch apparatus, automatic, A. Schlatter	611,809
Switching and telephone system, automatic, L. G. Nilson	611,974
Tables, revolving centerpiece for dining, W. H. Pease	611,739
Telegraph key, F. E. Lewis	611,919
Thermal expansion engine, G. A. Marconnett	611,813
Thill or pole coupling, vehicle, W. L. Umstead	611,665
Thill or tongue coupling for vehicles, J. M. Day	611,857
Thrashing machine, Hall & Heilman	611,903
Ticket, railway, Hodgins & Young	611,736
Tile, E. S. Thomas	611,763
Tilting gate, E. C. Compher	611,608
Tire and wheel, bicycle, R. H. Southall	611,715
Tire, pneumatic, Y. Western	611,745
Tire setting machine, C. Mathisen	611,864
Tires, tool for repairing pneumatic, E. R. Meeker	611,972
Tool, combination, J. W. Newbrough	611,953
Tool head, W. R. Jenkins	612,002
Top, spinning, G. A. Sahlender	611,761
Toy, J. C. Briggs	611,887
Toy puzzle, A. B. Greene	611,840
Trace fastener, W. T. Parsons	611,706
Traction engine, C. L. & R. A. Schultz	611,711
Translating devices, method of and means for controlling energy delivered to, H. W. Leonard	611,970
Trap. See Animal trap. Pigeon trap.	
Tree moving apparatus, E. & H. Hicks	611,695
Tricycle, hand and chain operated, F. Arnold	611,764
Trolley ear, H. Geisenhoner	611,752
Trousers rack, R. Norris	611,929
Trousers leg stretcher, P. D. Halsey	611 841
Truck, Brown & Burns	611,880
Truck, brick drying, O. Howl	611,945
Truck, grain, Doty & Dollahan	611,613
Trunk protector, L. F. Snapp	611,848
Tub. See Bath and wash tub.	
Tufting machine, H. J. Sonder	611,849
Valve, J. L. Cook	611,894
Valve, faucet, F. F. Field	611,781
Valve, plug, H. A. Freeman	611,899
Vaults, apparatus for ascertaining temperature of, Pebl & Markel	611,866
Velocipede gear case, Tuby & Blackmore	611,824
Velocipede, railway, J. Donavan	611,884
Vessels, apparatus for floating stranded, S. Lake	611,636
Washboiler, L. Anderson	611,804
Washing machine, S. M. Musgrave	611,701
Watchcase spring, W. Arthur	611,748
Water motor, W. Turner	611,874
Water wheel, J. D. Campbell	611,769
Weather strip and door check, combined, N. F. Cave	611,676
Wheel. See Water wheel.	
Whiffletree connection, G. Heon	611,735
Winding machine, thread, T. Hansen	611,627
Window screen, E. E. Monroe	611,924
Winning mechanism, coal, F. H. Heise	611,810
Wire, loom for weaving, D. S. Birrell	611,602
Wire stretcher, Thorp & Leddy	611,638
Wire winding machine, E. S. Morkre	611,817
Wireworking machines, automatic stop mechanism for, H. T. Jenkins	612,000
Wrench, D. A. Cheney	611,771
Zinc and copper ores, treatment of, W. J. Koehler	611,917

DESIGNS.

Badge, D. M. J. Wall	29,432
Car coupling knuckle, J. Timms	29,446, 29,447
Chest or bin, M. F. Brown	29,439
Clock case or similar article, P. Best	29,434
Coffee pot, H. E. Guyn	29,437
Curtain border, J. W. Doran	29,458
Electrical instrument case, W. A. Layman	29,451
Fabric, W. Keil	29,460, 29,461
Fasteners, socket member for detachable, E. Pringle	29,445
Game board, L. D. Shears	29,454
Grate attachment, G. R. Connally	29,442
Hammock, I. E. Palmer	29,455
Heel, W. T. Summers	29,452
Heel plate, E. Lehman	29,453
Label, H. H. Jacobus	29,456
Mat, L. D. Parker	29,459
Match box, J. J. B. McElrath	29,435
Nail files or similar articles, handle for, J. Theobald	29,433
Plow point, W. F. Ziegler	29,444
Railway brace, D. Cater	29,448
Shade hanger bracket, Berger & Herrmann	29,449
Shipping vessel, G. A. Fiaccus	29,438
Sifter, ash pan, F. H. Dreyer	29,441
Spool or tube holder, G. W. King	29,436
Sprocket wheel or gear, C. S. Dikeman	29,450
Stove top, gasoline, C. A. Herr	29,440
Tape, J. B. Sidebotham	29,457
Tool, garden, G. C. Pearson	29,443

TRADE MARKS.

Carbons, electric light, Schiff, Jordan & Company	32,037
Cars, railway freight and passenger, Union Pacific Railroad Company	32,036
Cure for rheumatism, J. M. Hunnicutt	32,025
Dyestuffs, Farbenfabriken of Elberfeld Company	32,030
Hooks and eyes, American Pin Company	32,033
Knives, spoons, shaves, and shoe tools, Hyde Manufacturing Company	32,034
Lozenges, perfumed, Searle & Hereth Company	32,026
Medical preparations destructive of bacteria, C. Patin	32,020
Oil, kerosene, W. Sandover & Company	32,031
Oil, sewing machine and bicycle, Griggs, Cooper & Company	32,032
Paint, Carrara Paint Company	32,029
Paper fabric, wrapping or packing paper, paper interlinings and paper wearing apparel, Arkell & Smiths	32,019
Pile cure, vegetable powder, J. Bardenheier	32,023
Remedy for arthritis, rheumatism and like diseases, Chemische Fabrik Sulzbach Gesellschaft mit Beschrankter Haftung	32,022
Remedy for diseases of the blood and infectious diseases, certain, Chemische Fabrik Sulzbach Gesellschaft mit Beschrankter Haftung	32,021
Remedy for stomach and blood diseases, C. K. Newcomb	32,024
Sauces for meats, J. C. Henderson Machine Motor and Manufacturing Company	32,028
Washing machines, Whipple Brothers	32,035

LABELS.

"Chief Engineer," for cigars, American Lithographic Company	6,686
"City Troop," for cigars, American Lithographic Company	6,684
"Cream," for flour, Meek, Finger & Company	6,691
"Garnothol," for a bactericide, F. Dodsworth	6,693
"Gloria Mundi, 'One Aim,' 'One Goal,'" for cigars, American Lithographic Company	6,683
"Gloria Mundi," for cigars, American Lithographic Company	6,685
"My Choice," for flour, Meek, Finger & Company	6,688
"Our Calla," for flour, Meek, Finger & Company	6,690
"Our Crown," for cigars, American Lithographic Company	6,687
"Phillips' Face Lotion," for a medicine for skin diseases, R. D. Phillips	6,692
"Snow Drops," for flour, Meek, Finger & Company	6,689

PRINTS.

"Sister in Chief," for cigars, American Lithographic Company	79

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

For Amateurs and Professionals.
Put up in powder form in gelatine tubes ready for immediate use when dissolved in water. Specially prepared for all kinds of dry plates, films, transparencies, lantern slides, bromide and velox papers, snap shot or time exposure after scientific study of their emulsions. Saves time, is rapid and controllable in action, will not spoil, does not stain the hands, dissolves easily and renders the nicest gradations in high lights and shadows. Every amateur can obtain artistic results. Recommended by leading dry plate manufacturers, photographers, etc. Tubes ready for immediate use (make 30 oz. or 1¼ pt. best developer) **25 cents each.** 1 doz. tubes packed in neat box $3.00. Pure TOLIDOL per pound $9.00, half pound $4.50, ounce 60 cents. Sold by best dealers or sent post paid upon receipt of price. In ordering tubes specify kind of plate or film and whether for snap shot or time exposure. Booklet free.
Haller-Kemper Co., Sole Agents, Atlas Block, Chicago.

THE NEW BRISTOL COUNTER

Registers an accurate account of work done on printing presses, grain tallies, weighing, measuring and other automatic machines. Counts up to 1,000,000 and repeats automatically. Simple, accurate, durable. Special counters to order. ☞ *Send for circular.*
C. J. ROOT, Bristol, Conn., U. S. A.

DO YOU USE GRINDSTONES?

If so, we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches & Elevators
PROVIDENCE R. I.

BONE MILLS for RAW BONES

(F. Wilson Patent). Capacity from one-half ton to 40 tons.
WILSON BROS., Easton, Pa., U.S.A.

PIERCE VAPOR LAUNCHES 16 to 20 Feet, $150 AND UP. 14 FT. FISHING LAUNCH.
STATIONARY AND PUMPING ENGINES.

☞ *Send for Catalogue Stating Size.*
PIERCE ENGINE COMPANY, 17 N. 17TH STREET, RACINE WIS.

Grey Iron Castings
for all purposes, made to order. Quality guaranteed. Write us at ERIE, PA.
WALKER FOUNDRY COMPANY

50 YEARS' EXPERIENCE
PATENTS
TRADE MARKS
DESIGNS
COPYRIGHTS &C.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.
Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.
MUNN & Co. 361 Broadway, New York
Branch Office, 625 F St., Washington, D. C.

Santiago Squadron
PHOTOGRAPHS
Geo. P. Hall & Son, General Photographers
157 FULTON ST., NEW YORK.

THE DEFIANCE MACHINE WORKS
ESTABLISHED 1850.
DEFIANCE, OHIO, U.S.A.
MANUFACTURERS OF SPECIAL WOOD WORKING MACHINERY FOR HUB, SPOKE, WHEEL, BENDING, WAGON, CARRIAGE, SHAFT, POLE, NECK-YOKE, SINGLETREE, HANDLE & BARREL-HOOP FACTORIES
LARGEST LINE IN THE WORLD
SATISFACTION GUARANTEED.

Sand Belt Machine

HELP WANTED.

A Few Additional Apprentices will be received by R. Hoe & Co., Printing Press Manufacturers, to learn the Machinists' Trade in its various branches. Attendance at the firm's evening school three evenings each week is expected. Apply personally or by letter
R. HOE & CO., 504 Grand Street, NEW YORK.

MODELS **WE ASSIST INVENTORS.** *Ideas for Asking.* ☞ *Catalogue Free.* J. C. SEYL, 181 Madison St., CHICAGO.

FOOT AND POWER LATHES, PLANERS AND DRILL PRESSES. H. L. SHEPARD, Agent, Manufacturer, 141 & 143 W. 2d St., Cincinnati, O.

REFRIGERATION One to 25 tons daily capacity. **Challoner's Sons,** Oshkosh, Wis ICE MACHINE

ICE **MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery.** THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

MAGICAL APPARATUS, all kinds. Send 20c. for large Catalogue. Small edition free. MARTINKA & CO., NEW YORK.

MODELS & GEARS CATALOGUE FREE. UNION MODEL WORKS 193 CLARK CHICAGO.

NOVELTIES & PATENTED ARTICLES
Manufactured by Contract. Punching Dies, Special Machinery. E. Konigslow & Bro., 181 Seneca St., Cleveland, O.

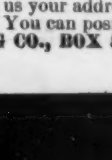
Manufacturers of Hardware Specialties can buy valuable Patents. Complete Monopoly of stable goods in U. S. and foreign countries. Address E. G. Bennett, 2 Parlin St., Everett, Mass.

STEEL TYPEWRITER DIES
TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY
NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT 1123. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for 1897 catalogue.

Experimental & Model Work
Cir. & advice free. Wm. Gardam & Son, 45-51 Rose St., N.Y.

Notice the Shape of the Bar.



C BOX METAL.
LOBE Composition Wire Belt Lacing
Made in 4 sizes *Send for circular and prices.*
J. M. HAYDEN & CO., Mfrs.
60 Pearl St., Grand Rapids, Mich.

MAGIC
Stage Illusions and Scientific Diversions, Including Trick Photography.
By A. A. HOPKINS.
568 pages. 420 illustrations. Price, $2.50.

This work appeals to old and young alike, and it is one of the most attractive holiday books of the year. The illusions are illustrated by the highest class of engravings, and the exposés of the tricks are, in many cases, furnished by the prestidigitateurs themselves. Conjuring, large stage illusions, fire-eating, sword-swallowing, ventriloquism, mental magic, ancient magic, automata, curious toys, stage effects, photographic tricks, and the projection of moving photographs are all well described and illustrated, making a handsome volume. It is tastefully printed and bound.
Acknowledged by the profession to be the
STANDARD WORK ON MAGIC
☞ Circular of Contents and sample illustrations free upon request.
MUNN & CO., Publishers,
SCIENTIFIC AMERICAN OFFICE,
361 Broadway, New York City.

Ladies make $18 easy If you are in need of employment, send us your address, and we will show you how to make $18 a week easy and sure. If you are in need of employment, write to us at once. We guarantee that you can make $18 a week absolutely sure. You will be surprised at how easy it can be done. Send us your address anyway, it will be t your interest to investigate. Write today. You can positively make $18 a we easy. Address ROYAL MANUFACTURING CO., BOX 535, DETROIT, M

In Season and out of Season

Remember that a motor carriage with its rubber tires is equally available in the winter.

The Winton Motor Carriage

has passed through two winters without missing a day even on days when the street car system of our city was tied up in a blizzard.

They are selling faster than we can make them. Place your order to secure delivery. Variable speed Hydrocarbon Motor. Simple in construction and free from odor. Intending purchasers write for catalog.

Price $1,000. *No Agents.*

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.

STANDS A WORLD OF WEAR AND TEAR

Remington Standard Typewriter.

WYCKOFF, SEAMANS & BENEDICT,
327 Broadway, New York, N. Y.

$2.50

Simplest, Lightest Plate Camera

Eastman's No. 2 Eureka Jr.

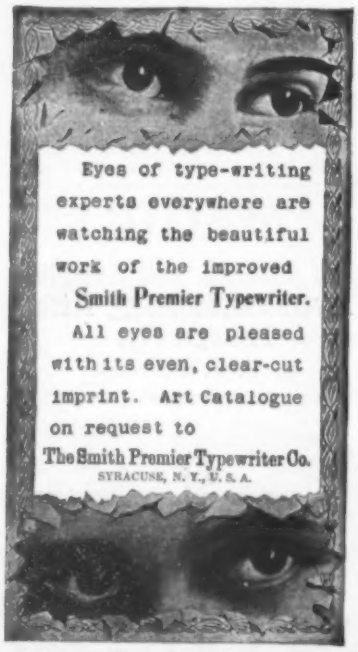
Takes pictures 3⅛ x 3⅛ inches; weighs but 12½ ounces.

Meniscus lens, rotary shutter, three stops, view finder, socket for tripod screw. Perfectly adapted to snap-shots or time exposures and equally convenient as a hand or tripod camera.

Price with plate holder, ... $2.50
Complete developing and printing outfit, . . 1.00

Catalogue of Eureka Cameras and Kodaks free at agencies or by mail.

EASTMAN KODAK CO.
Rochester, N. Y.


Eyes of type-writing experts everywhere are watching the beautiful work of the improved
Smith Premier Typewriter.
All eyes are pleased with its even, clear-cut imprint. Art Catalogue on request to
The Smith Premier Typewriter Co.
SYRACUSE, N. Y., U. S. A.

HELMET OIL LUBRICATES ANYTHING. IF YOU HAVE A HOT BOX TRY IT. C. H. BESLY & CO. CHICAGO, ILL. U.S.A.

PHOTOGRAPHY IN COLORS.—FORmulas for producing photographs in colors by the Chassagne process. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1114 and 1125. Price 10 cents each, by mail, from this office and from all newsdealers.

GUNDLACH OPTICAL Co
761-763 S CLINTON ST
ROCHESTER N Y
SEND FOR LIST
MANUFACTURERS OF
PHOTOGRAPHIC APPARATUS!
OUR NEW CYCLE OUTFIT CAN'T BE BEATEN FOR QUALITY OR PRICE

WHEELER · PATENT · WOOD · FILLER

assures a perfect and permanent finish on all natural interior woodwork.

BREINIG'S LITHOGEN SILICATE PAINT

is a paint that will outlast lead and oil, and is especially adapted for buildings exposed to salt air.

THE BRIDGEPORT WOOD FINISHING CO., New Milford, Conn.

240 Pearl Street, NEW YORK. 215 E. Lake Street, CHICAGO. 85 Oliver Street, BOSTON

"PEGAMOID" TRADE MARK
ALUMINUM PAINT.

Latest Application of Aluminum. Looks like Frosted Silver. Washable, Untarnishable, Water and Oil Proof, Durable, Easily Applied. Bicycles, Radiators, Pipes, Boats, Metal Work, Machinery, etc. Makes Tarnished Objects better than New. A Necessity in Household, in Machine Shop, and to Engineer. Sample Bottle and Circular for 25cts.

AMERICAN PEGAMOID CO., 348 Broadway, N. Y.

THOROUGH INSPECTIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY

STEAM BOILER EXPLOSIONS

J. M. ALLEN, President · W. B. FRANKLIN, Vice President
J. B. PIERCE, Secretary · T. B. ALLEN, 2d Vice President

25c. Worth of Tool Knowledge

All about every known Tool for every trade. Descriptive cuts of each with present market prices. Send 25 cents at once for

MONTGOMERY'S TOOL CATALOGUE

for 1898. 510 pages with index at back. A handy book for every machinist and foreman of workshop or factory. The finest and most accurate illustrations. Book is pocket size, 6¼ x 4¼ inches, with rounded edges. Address

MONTGOMERY & CO.
105 Fulton Street, New York.

CHARTER GASOLINE ENGINE
THE MOTOR OF THE 19TH CENTURY.
USED BY ANY ONE, IN ANY PLACE, FOR ANY PURPOSE.
CHARTER GAS ENGINE CO. BOX 148 STERLING, ILL

BALL BEARING AXLES AND RUBber Tires.—A paper read before the Carriage Builders' National Convention, Philadelphia, October, 1894, showing the advantage to be derived from the use of ball bearings and pneumatic tires in road vehicles. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 992. Price 10 cents. To be had at this office and from all newsdealers.

An Extra Engineer

not needed to look after the "Heintz" Steam Trap. It's automatic, sensitive, lasts for years. Operates by expansion of sealed tube, which closes the valve as live steam enters the trap—212°: valve open at 211°. Smallest size discharges a gallon of water a minute.

Guaranteed to give best results and save coal and steam. Our Booklet "H" interesting to users. Ask for it.

William S. Haines Company,
136 South Fourth St.
Philadelphia.

"The Heintz, the best, tho' it has imitators"

21 COPYRIGHT, 1897, BY THE WINTON CO., N. Y. 12

DRY BATTERIES.—A PAPER BY L. K. Bohm, treating of open circuit batteries, historical dry batteries, modern dry batteries, Hellesen's battery, Bryan's battery, Koller's battery, and the efficiency of dry cells. With three illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1001. Price 10 cents. To be had at this office and from all newsdealers.

Computing Figures

mentally is probably the hardest kind of toil known. The Comptometer makes it easy, is twice as quick, insures accuracy and relieves all mental and nervous strain. Why don't you get one? *Write for Pamphlet.*

FELT & TARRANT MFG. CO.
52-56 ILLINOIS ST., CHICAGO.

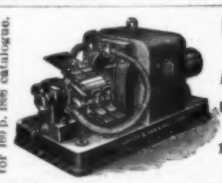
Gas Blast Furnaces

GAS PRODUCERS AND PRESSURE BLOWERS.

For Illustrated Pamphlets, apply to

AMERICAN GAS FURNACE CO.
23 John Street, New York, N. Y.

Send your business card for 160 p. 1898 catalogue.



NICKEL AND **Electro-Plating** Apparatus and Material.

THE Hanson & VanWinkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St. Chicago.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 100 useful articles, including Safes Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

PEPSALT PEPSALT

Indigestion has no terrors for him!

That salt-shaker is filled with Pepsalt.
It cures and prevents Indigestion.

PEPSALT is the best of table salt, into every grain of which is incorporated digestive substances natural to the stomach. Fill your salt-cellar with **PEPSALT** and use it in place of salt at your meals. If you have indigestion, your stomach does not supply the necessary amount of the dissolving or digestive juices. **PEPSALT** taken in place of salt at your meals makes good this deficiency, as you take with every mouthful of your food a similar substance to that which is required and at the right time, and your indigestion is a thing of the past. Send for sample in salt shaker bottle and try it. Price 25 cents, postpaid.

THE VAUPEL SAMARITAN CO.
48 Sheriff St., Cleveland, Ohio.

PEPSALT CURES AND PREVENTS INDIGESTION

CUFFS HELD . . .

with the **Improved Washburne Patent Cuff Holders** can be placed just where you want them; will never slip but may be instantly released. Drawers Supporters, easily adjusted or taken off—excellent for holding golf trousers. By mail, 25c. the pair. ☞ *Catalogue showing these and other novelties, free.*

American Ring Co., Box P, Waterbury, Conn.

National Tube Works Co.

McKEESPORT, PA., U. S. A.

THE Largest Makers of All Sizes and Kinds of Special WROUGHT MILD STEEL AND BEST WROUGHT IRON TUBULAR GOODS IN THE WORLD; control the Manufacture of Wrought Tubular Goods Made of a High Class of Mild Steel, FROM THE ORE to the FINISHED PRODUCT, and unqualifiedly recommend NATIONAL PIPE FOR ALL USES as Better than any other Pipe made.

LATHES Foot Power, High Grade
W. P. Davis Mach. Co., Rochester, N. Y.

CARBORUNDUM GRINDING MATERIALS IN ALL FORMS.

THE CARBORUNDUM CO., • NIAGARA FALLS, N. Y.

For Sale Low—1 25-H. P. Condensing Yacht Engine; 1 25-H. P. Side Wheel Engine; 1 50-ft. Launch. S. E. Hartham, Yachts, Launches, and Engines, Worcester, Mass.

Tribune Bicycles

$50.00 and Upward.

THE BEST IN THE WORLD.

☞ Handsome illustrated catalogue describing our full line of twenty-three models mailed free.

The Black Mfg. Co., Erie, Pa.

HALF A CENTURY OF CYCLES.—AN interesting history of the cycle from its origin up to the present time. The first crank-driven bicycle. The "bone-shaker" and its successors. The tricycle. The modern wheel. Cycle building a science. Points of improvement. The pneumatic tire. A hand and foot cycle. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1012. Price 10 cents. To be had at this office and from all newsdealers.

. . . RIDE A . . .

WHEELER SADDLE

And Enjoy Your Wheel.

This cut shows our Model "Extra," made in two widths.

List Price with Coil Springs, $4.50
Without Coil Springs, - - - 4.00

High grade in every respect, soft nose, hair padded, with or without coil springs. Graceful, Light, Durable and Strictly Hygienic. ☞ *Write for Catalogue.*

THE WHEELER SADDLE CO.

38 CONGRESS ST. W., DETROIT, MICH.

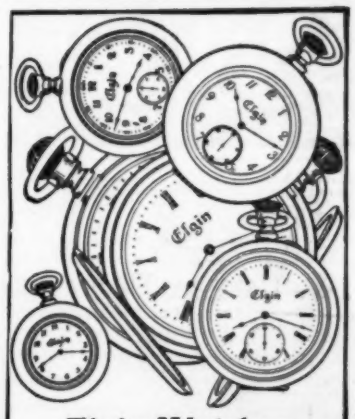
Agents wanted in South America and Mexico.

SAVES MONEY AND HEALTH!

Cortland Howe Ventilating Stove.

Only Scientific, Practical and Successful Heating and Ventilating Stove. *It warms the same amount of space with half the fuel consumed by a furnace or ordinary stoves, brings in fresh, warm air and takes out foul air.* 4 International awards, 12 medals and diplomas, over 30 first premiums. Specified by the U. S. War Dept. Endorsed by Professors in Yale, Cornell, Michigan, and other Universities and Colleges. Over 25,000 in use. *Send for Circular "S. A."*

Cortland Howe Ventilating Stove Co.,
Cor. Main & Tompkins St., Cortland, N. Y.



Elgin Watches

vary in size but not in time telling—accuracy is an attribute of all Elgin Watches—

Full Ruby Jeweled Elgins

can be had of all jewelers—they know their good points in detail—ask them.

An Elgin Watch always has the word "Elgin" engraved on the works—fully guaranteed.

SUBMARINE TELEGRAPH.—A POPular article upon cable telegraphing. SCIENTIFIC AMERICAN SUPPLEMENT 1134. Price 10 cents. For sale by Munn & Co. and all newsdealers.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
Wm JESSOP & SONS LTD 91 JOHN ST. NEW YORK

PRINTING INKS

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York